CQ

June 1976

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CQ WWDX CONTEST PHONE RESULTS

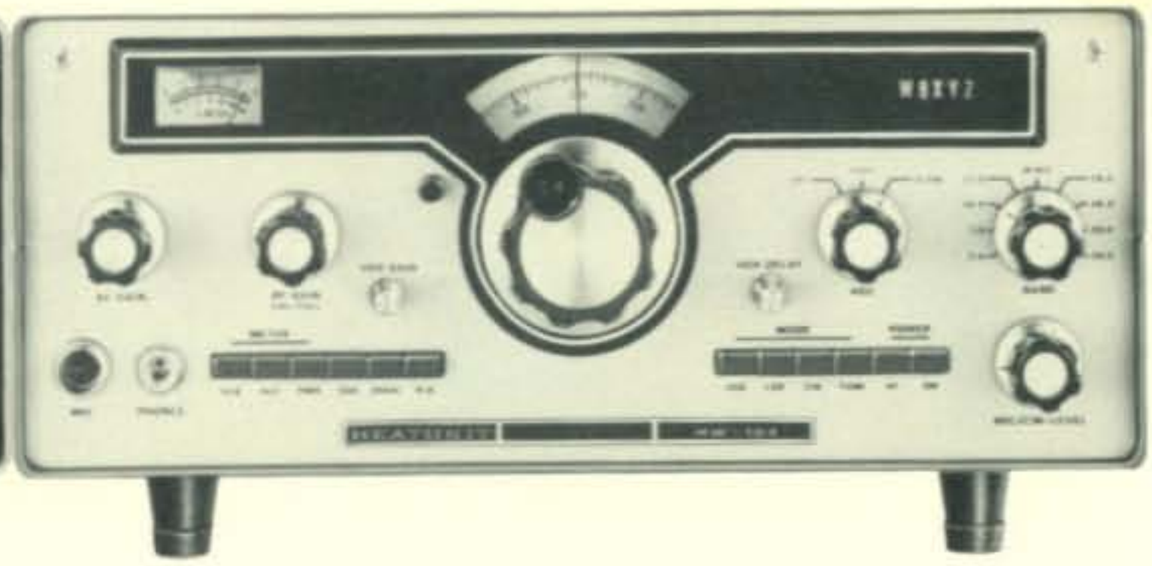
...see page 26

The Radio Amateur's Journal

State of the Art...

Heathkit SB-104

Heathkit HW-104



Whether you choose the SB-104, or the HW-104, you're getting one of the finest Amateur transceivers you can buy at any price. And because you build them yourself, you get a feel for the equipment you simply can't duplicate with ready-made units.

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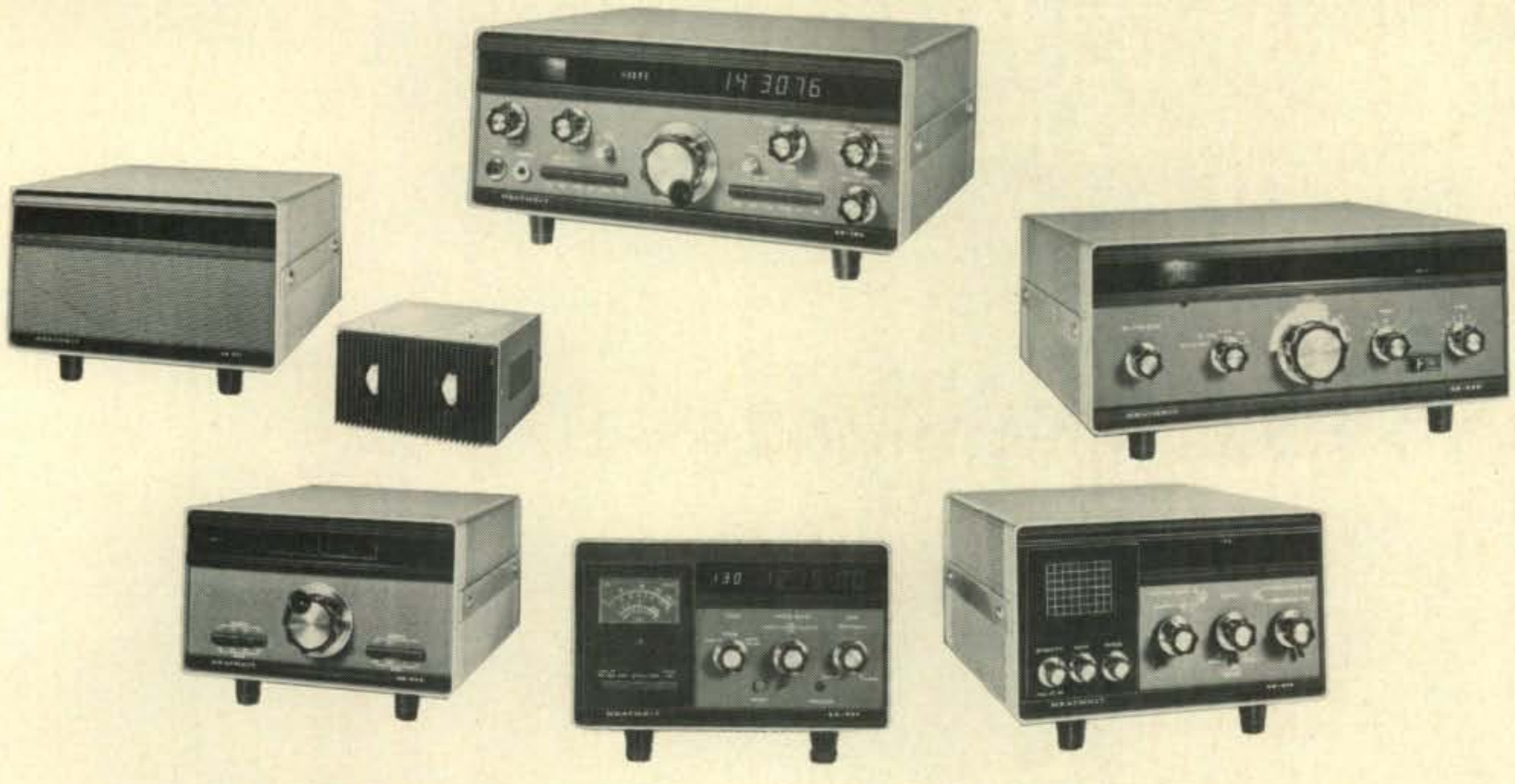
Station of the Art...

The SB-104 with sophisticated station accessories. Unquestionably, some of the finest Amateur gear you can own.



Clockwise from top:

SB-104 Transceiver:

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Kit SB-230, Shpg. wt. 40 lbs. **369.95**

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SB-634 Station Console: 24-hour clock, 10-minute ID timer, RF wattmeter, SWR bridge, phone patch.
Kit SB-634, Shpg. wt. 14 lbs. **179.95**

SB-644 Remote VFO: For split transmit/receive on SB-104. Not for HW-104.
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Kit SB-604, For SB-104 Shpg. wt. 8 lbs. **29.95**
Kit HS-1661, For HW-104 Shpg. wt. 5 lbs. **19.95**
Useful options for both the SB-104 and HW-104.
SBA-104-1, Noise Blanker, Shpg. wt. 1 lb. **26.95**
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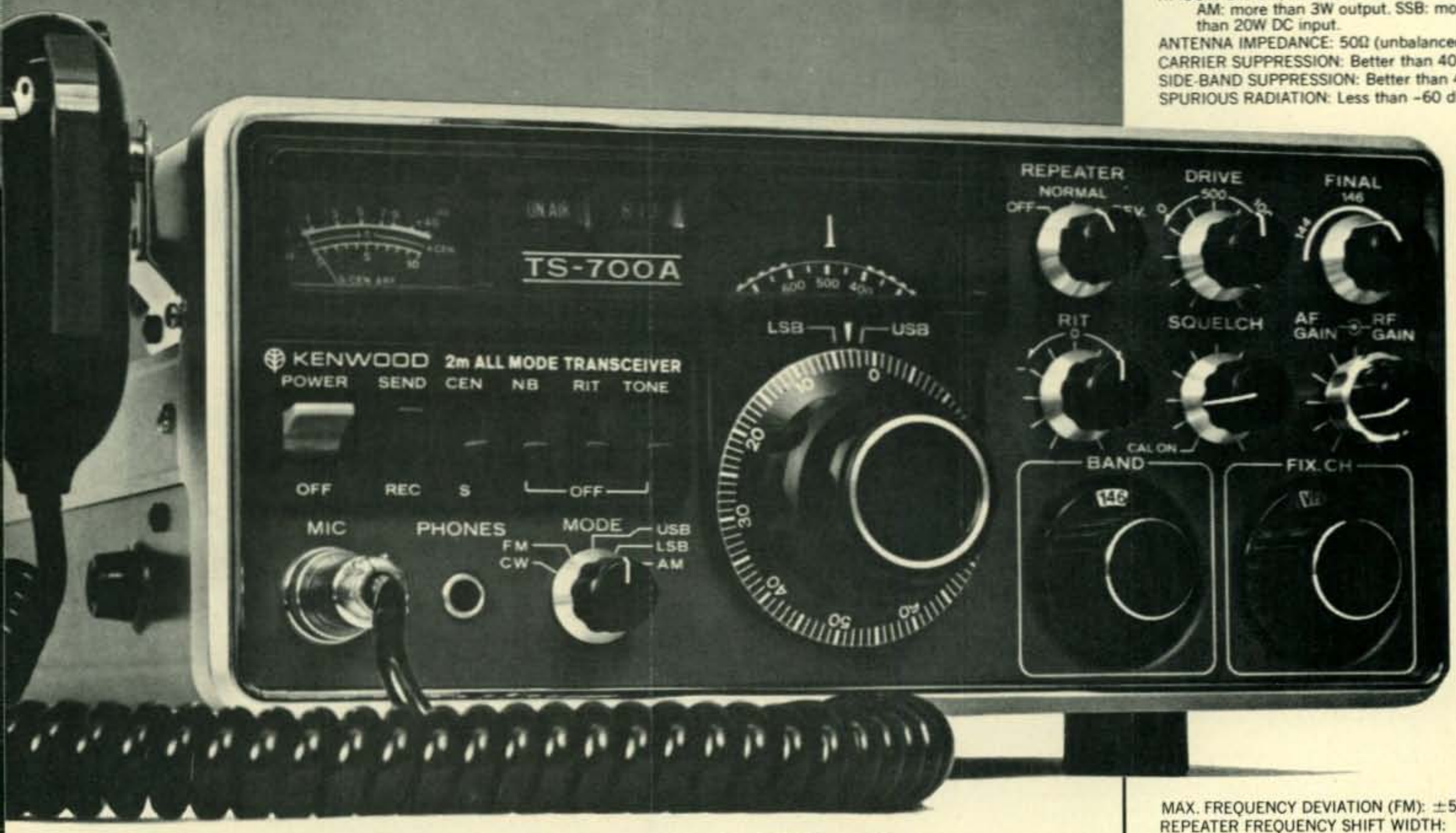

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Specifications TS-700A

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RF OUTPUT: CW, FM: more than 10W output. AM: more than 3W output. SSB: more than 20W DC input.
ANTENNA IMPEDANCE: 50Ω (unbalanced)
CARRIER SUPPRESSION: Better than 40 dB
SIDE-BAND SUPPRESSION: Better than 40 dB
SPURIOUS RADIATION: Less than -60 db
MAX. FREQUENCY DEVIATION (FM): ±5 kHz
REPEATER FREQUENCY SHIFT WIDTH: 600 kHz
TONE BURST TIME: 0.5-1.0 sec.
MODULATION: Balanced modulation for SSB. Variable reactance frequency shift for FM. Low power modulation for AM.
MICROPHONE: Dynamic microphone, 500Ω
AUDIO FREQUENCY RESPONSE: 400-2600 Hz, within -9 db
RECEIVING SYSTEM: SSB, CW, AM: Single-superheterodyne. FM: Double-superheterodyne.
INTERMEDIATE FREQUENCY: SSB, CW, AM: 10.7 MHz. FM: 1st IF: . . . 10.7 MHz. 2nd IF: . . . 455 kHz.
RECEIVING SENSITIVITY: SSB, CW: S/N = 10 dB or better at 0.25μV. 20 dB noise quieting = Less than 0.4μV. AM: S/N = 10 dB or better at 1μV.
IMAGE RATIO: Better than 60 dB
IF REJECTION: Better than 60dB
PASS-BANDWIDTH: SSB, CW, AM: More than 2.4 kHz at -6 dB. FM: More than 12 kHz at -6 dB.
RECEIVER SELECTIVITY: SSB, CW, AM: Less than 4.8 kHz at -60 dB. FM: Less than 24 kHz at -60 dB.
SQUELCH SENSITIVITY: 0.25μV
AUDIO OUTPUT: More than 2W at 8Ω load (10% distortion)
RECEIVER LOAD IMPEDANCE: 8Ω
FREQUENCY STABILITY: Within ±2 kHz during one hour after one minute of warm-up, and within 150 Hz during any 30 minute period thereafter.
POWER CONSUMPTION: Transmit mode: 95W (AC 120/220V), 4A (DC 13.8V), max. Receive mode (no signal): 45W (AC 120/220V), 0.8A (DC 13.8V).
POWER REQUIREMENTS: AC 120/220V, 50/60 Hz. DC 12-16V (13.8V as reference).
DIMENSIONS: 278 (W) x 124 (H) x 320 (D) mm
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JUNE, 1976 VOL. 32, NO. 6

The Radio Amateur's Journal

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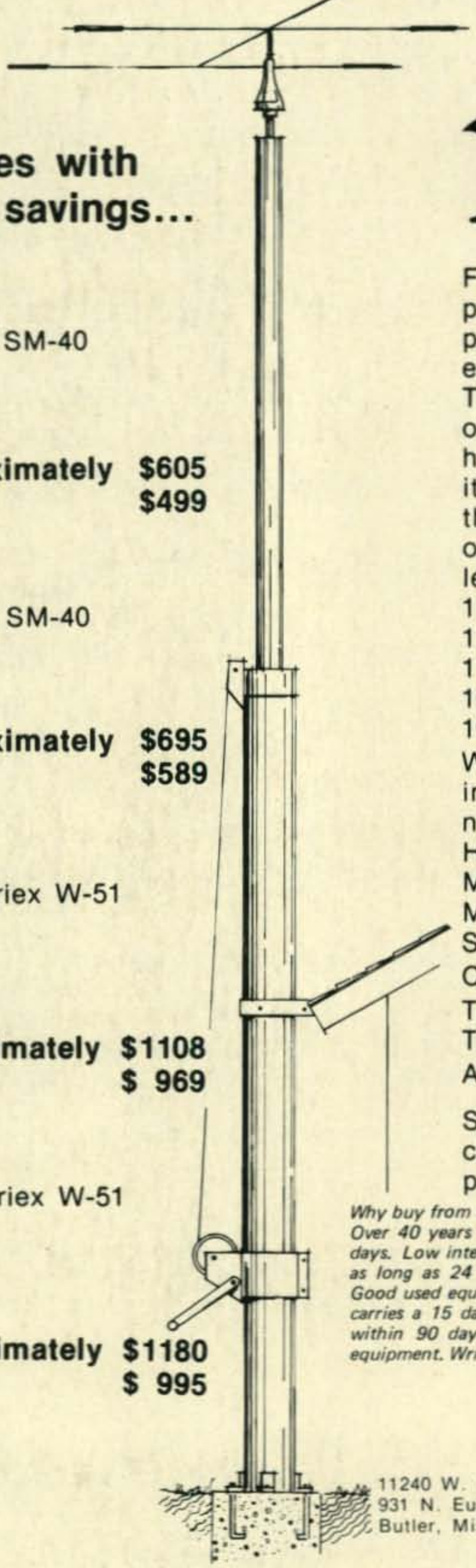

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Zero Bias

What's amateur radio really all about? It's about a group of people under some general auspices each going their own way pretty much until some specific task or function brings them together. We *can* get together in times of disaster or public need. We *do* act in numerical concert for contests and many other short-range goal-orientated activities. What about the long haul?

What does it take to prompt amateurs as a group to effect change or impliment ideas on matters that are of great concern eventually to all amateurs? Fundamentally the question should be one of "How much say do I have and should I have over my intellectual, psychological and economic investment in amateur radio?"

Amateur radio per se does not drop like manna from the heavens but in fact is a tightly regulated pursuit. It is not and should not be construed as merely a pastime or hobby lest you can demonstrate how photography, stamp collecting or woodworking is politically regulated both nationally and internationally. We are involved with, formed by, and regulated by politics. Politics is not a dirty word or even one that is to be shunned or even a concept and/or abstraction that we amateurs are "above" or can choose to transcend. It is "how things work" and a tool or expedient for getting what you want accomplished.

Amateur radio is also a business. It supports not only the amateurs who work for and including manufacturers, distributors both wholesale and retail, service people, dealers in used equipment, manufacturers surplus, large firms, small firms and basement firms ritht down to the individuals who buy and sell through classified advertising. Money is routinely exchanged in the course of our 'hobby". We also support in various ways four publishing houses expressly devoted to disseminating information and providing additional enjoyment for our "pastime". All four *sell* a product, pay employees and expenses, and hopefully make a profit. We can argue the point with regard to the ARRL as they claim not to separate membership from *QST*. *QST* then is thereby defined as an official organ for their membership. The argument is a bit shaky when you consider that an individual can (and does) enter retail establishments and buy *QST* without being or becoming a member. I cannot envision taking a walk to my local stationary store or even going to an electronic distributor and picking up the latest copy of the *IEEE Journal*.

Another consideration in placing ourselves on the social spectrum is that despite all claims, no one body or organization speaks for amateur radio. There is no spokesperson that can honestly say that they represent 51% of all licensed amateurs on any matter. Every individual from the fledgling Novice to the corporate head of an electronic conglomerate has some vested interest in amateur radio. We all want something even if it's only to be left alone.

Is this situation good, bad, indifferent, or haven't you been personally touched yet by something beyond your immediate control? We are, whether we want to look at it or not, products of this system. I think basically the system is good and workable. It's faults lie within what we choose to see and what we choose to ignore for whatever reason. What and who are we responsible to, and what are we going to do about it?

First we are responsible to ourselves as amateurs and as amateurs we are responsible collectively for each other. We owe it to ourselves and others to use this system politically and economically to get what we want and to protect what we have. It is not un-American or un-amateur to exercise your rights to be heard, on the contrary it is just this fact that we are celebrating next month.

From time to time we receive mail from readers who are for or against something, pro or con League actions, questioning the actions of the FCC, decrying the practises of certain manufacturers and distributors and just wouldn't it be nice if" kind of letters. We at *CQ* cannot be all things to all people nor wave a banner on high for each cause or issue. We can and do publish what you are doing and whatever facts are available in each instance. This enables your fellow amateur (and mine) to find out what's happening out there *for, to,* and *against* his best interests.

One new developement *for* you was conceived recently by Randy Randall, K4EAR, and Carl Commander, W4ZRH, co-founders and interim officers of an organization called ARPAC (Amateur Radio Political Action Committee). This organization potentially can be a direct nation-wide spokesman for amateur radio.

This May I spent 3 days with Randy and Carl in Columbia South Carolina going over the ARPAC concept and attending an organizational meeting with amateurs from all over the state. It wasn't an anti-League meeting or strictly a meeting promoting some pet issue either. It was a group of amateurs who wanted to have some say in what was going on and how to make things better for amateur radio. Later that evening at a Sough Carolina amateur radio week dinner attended by Congressman Floyd Spence and Senator Dooley of South Carolina, Congressman Spence reitterated the basic fact of numbers. He was but one Congressman of many and in order to get things done you need the input of many Congressman. His view was that ARPAC was a step in the right direction to make amateur radio's wants known to the FCC and to the federal government.

Presumably ARPAC's will be set up in each state with representation coming from each Congressional District. This would give input to officials on a local level and provide a strong statewide voice of opinion to all elected officials. Some form of nation wide ARPAC is also being considered. The group will meet again in July at the Charlestown Hamfest (see Announcements column) to elect permanent officers and to get down to specific aims and goals ARPAC's can work towards. Two of the key issues are expected to be RM-499 and Incentive Licensing. The interest is there, and providing South Carolina can organize a sizeable portion of her 2000 amateurs, ARPAC's will be a considerable influence and power in amateur radio.

I suggest that if any of you are interested in the possibility of starting your own ARPAC to contact either Randy Randall, K4EAR, 7005 Nursery Road, Columbia South Carolina 29210 or Carl Commander, W4ZRH, Rifle Range Road, Mt. Pleasant, South Carolina 29464. It's an exciting way to get involved in your own destiny.

73, Alan, K2EEK

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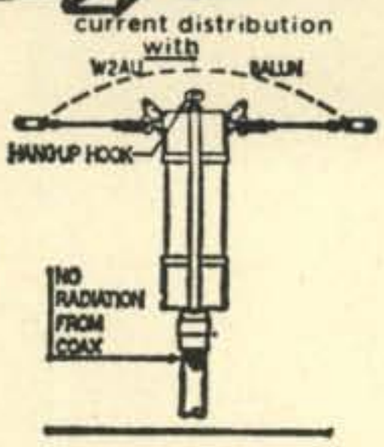

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Our Readers Say

It's All Canadian

Editor, *CQ*:

In WB5OXC's article about the DXCC and Countries List in April *CQ*, he says, on page 19:

". . . . This is shown in Canada where the Yukon Territory and the Northwest Territories lie next to Canada, but they all count for one country."

However, Yukon and N.W.T. are a part of Canada just as much as, for example, Texas is a part of the United States. Perhaps he was confusing the situation with that of the Atlantic Province of Newfoundland: they joined Canada in 1949. That is why they have the VO1 call, and Labrador, the mainland portion of the province, has the VO2 call. Previously, they were colonies. While VE and VO1/2 are one country, we have the French Islands of St. Pierre and Miquelon, FP8, between Nova Scotia and Newfoundland. One thing about Ham Radio: you learn geography.

Ford Warner, VE7DDF
Victoria, B.C. Canada

Positive Feedback

Editor, *CQ*:

I hope that *CQ* will support my petition to the FCC (RM 2665) that calls for examination reports that will tell the ham applicant the grade he got on the exam. The FAA provides such exam reports to the 750,000 people who have gotten pilot's licenses (and to the failures). The FCC can do the same.

Nickolaus Leggett, WA3YFU
Washington, D.C.

All applicants for Amateur and Commercial radio operator licenses should be given an examination report that shows the grade they got on their license examination. In addition to the numerical score, this report should indicate the general subject areas where the applicant was weak. These subject areas would be such items as Transmitters, Antennas, Regulations, etc.

These reports would help the applicant improve his knowledge and upgrade his license class. This type of report is provided by the Federal Aviation Administration to people who have taken the pilot's written examinations. A similar computerized report could be used by the Commission.

Modern educational theory indicates that detailed feedback is important to learning. Just knowing that one passed or failed the examination is not sufficient.

Different Strokes

Editor, *CQ:*

Fine new look you're showing! I really don't object as do so many of us

(Continued on page 79)

KENWOOD'S TS-520

...worth waiting for!

Why wait any longer for a rig that offers top performance, dependability and versatility . . . the TS-520 has proven itself in the shacks of thousands of discriminating amateurs, in field day sites, in DX and contest stations, and in countless mobile installations.

Superb craftsmanship is evident throughout . . . in its engineering concepts as well as its construction and styling . . . craftsmanship that is a Kenwood hallmark.

Maybe the Kenwood TS-520 is the one you have been waiting for.

Kenwood offers accessories guaranteed to add to the pleasure of owning the TS-520. The TV-502 transverter puts you on 2-meters the easy way. (It's completely compatibile with the TS-520.) Simply plug it in and you're on the air. Two more units designed to match the TS-520 are the VFO-520 external VFO and the model SP-520 external speaker. All with Kenwood quality built in.

Specifications TS-520

MODES: USB, LSB, CW
POWER: 200 watts PEP input on SSB, 160 watts DC input on CW
ANTENNA IMPEDANCE: 50-75 Ohms, unbalanced
CARRIER SUPPRESSION: Better than -45 dB
UNWANTED SIDEBAND SUPPRESSION: Better than -40 dB
HARMONIC RADIATION: Better than -40 dB
AF RESPONSE: 400 to 2600 Hz (-6 dB)
AUDIO INPUT SENSITIVITY: 0.25μV for 10 dB (S+N)/N
SELECTIVITY: SSB 2.4 kHz (-6 dB), 4.4 kHz (-60 dB). CW 0.5 kHz (-6 dB), 1.5 kHz (-60 dB) (with accessory filter)
FREQUENCY STABILITY: 100 Hz per 30 minutes after warmup
IMAGE RATIO: Better than 50 dB
IF REJECTION: Better than 50 dB
TUBE & SEMICONDUCTOR COMPLEMENT: 3 tubes (2 x 6146B, 12BY7A), 1 IC, 18 FET, 44 transistors, 84 diodes
DIMENSIONS: 13.1" W x 5.9" H x 13.2" D
WEIGHT: 35.2 lbs.
SUGGESTED PRICE: $629.00

VFO-520

Provides high stability with precision gearing. Function switch provides any combination with the TS-520. Both are equipped with VFO indicators showing at a glance which VFO is being used. Connects with a single cable and obtains its power from the TS-520. Suggested price: $115.00.

SP-520

Although the TS-520 has a built-in speaker, the addition of the SP-520 provides improved tonal quality. A perfect match in both design and performance. Suggested price: $22.95.

TV-502

TRANSMITTING/RECEIVING FREQUENCY: 144-145.7 MHz, 145.0-146.0 MHz (option).
INPUT/OUTPUT IF FREQUENCY: 28.0-29.7 MHz
TYPE OF EMISSION: SSB (A3J), CW (A1)
RATED OUTPUT: 8W (AC operation)
ANTENNA INPUT/OUTPUT IMPEDANCE: 50Ω
UNWANTED RADIATION: Less than -60 dB
RECEIVING SENSITIVITY: More than 1μV at S/N 10 dB
IMAGE RATIO: More than 60 dB
IF REJECTION: More than 60 dB
FREQUENCY STABILITY: Less than ±2.5 kHz during 1-60 min after power switch is ON and within 150 Hz (per 30 min) thereafter.
POWER CONSUMPTION: AC 220/120V, Transmission 50W max., Reception 12W max. DC 13.8V, Transmission 2A max., Reception 0.4A max.
POWER REQUIREMENT: AC 220/120V, DC 12-16V (standard voltage 13.8V)
SEMI-CONDUCTOR: FET 5, Transistor 15, Diode 10.
DIMENSIONS: 6⅝" W x 6" H x 13¼" D
WEIGHT: 11.5 lbs.
SUGGESTED PRICE: $249.00

CW-520
500 Hz CW Crystal Filter: $45.00.

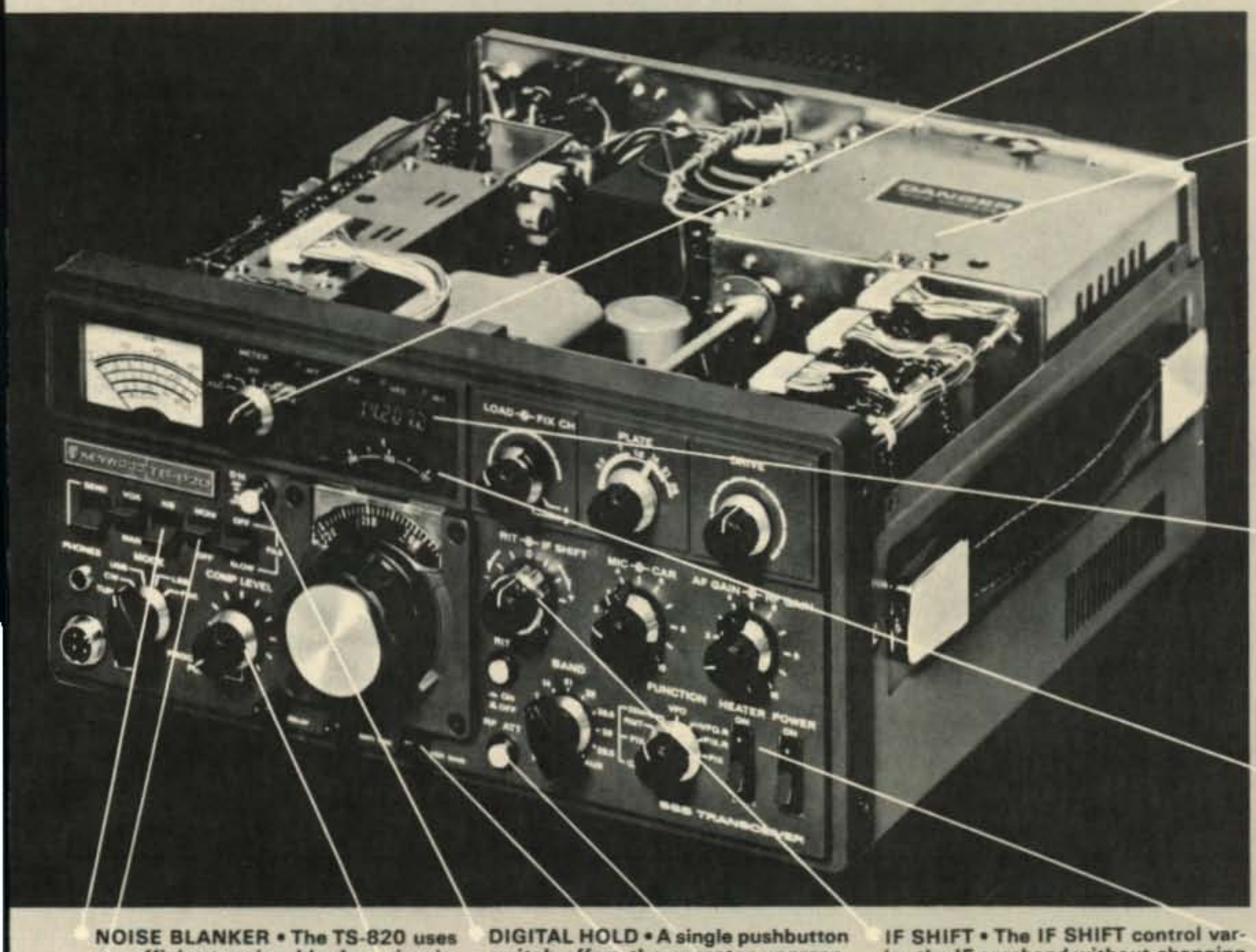
Prices subject to change without notice

KENWOOD'S TS-820 *the Pacesetter*

LIMITED QUANTITIES AVAILABLE IN JULY

Kenwood's well deserved reputation for fine craftsmanship and superb performance has never been more evident than in the TS-820. As a result of a host of innovative features being brought together, the 820 offers a degree of versatility, performance and pleasure second to none.

The Kenwood TS-820 is destined to be the world's new standard of excellence in amateur radio for years to come . . . a true "Pacesetter".



Features

PLL • The TS-820 employs the latest phase lock loop circuitry. The single conversion receiver section performance offers superb protection against unwanted cross-modulation. And now, PLL allows the frequency to remain the same when switching sidebands (USB, LSB, CW) and eliminates having to recalibrate each time.

FULL METERING • During receive, an easy to read meter functions as an S-meter. The same meter displays ALC level, plate current, RF output, and plate voltage during transmit. Includes COMP setting for adjusting the compression level of the built-in speech processor.

FINAL AMPLIFIER • The TS-820 is completely solid state except for the driver (12BY7A) and the final tubes. Rather than substitute TV sweep tubes as final amplifier tubes in a state of the art amateur transceiver, Kenwood has employed two husky S-2001A (equivalent to 6146B) tubes. These rugged, time-proven tubes are known for their long life and superb linearity. The input power of the TS-820 is conservatively rated at 160 W DC, 200 W PEP. Tubes run cool with the aid of a noiseless fan (standard) mounted on the rear panel. The above tube and power combination minimizes the possibilities of TVI and helps to maintain the Kenwood reputation for excellent audio quality.

DIGITAL READOUT DG-1 • (optional) A digital counter display can be employed as an integral part of the VFO readout system. Counter mixes the carrier, VFO, and first heterodyne frequencies to give *exact* frequency. Figures the frequency down to 10 Hz and digital display reads out to 100 Hz. Both receive and transmit frequencies are displayed in easy to read, Kenwood Blue digits.

DRS DIAL • Includes the same satin-smooth planetary drive found on other fine Kenwood models plus special, high-precision gears to add a new "monoscale" feature for easier frequency readout. LSB, USB, and CW operating frequencies can be accurately read from the same pointer.

HEATER SWITCH • The filaments of the three vacuum tubes may be turned off during periods of "receive only".

CW AUDIO CHARACTERISTICS • During CW reception, a special filter is used to alter the audio frequency response to provide a more comfortable, easy to copy tone.

Other features include:
- Built-in 25 kHz calibrator*
- Built-in speaker*
- CW Sidetone and semi-break in*
- Rear panel terminals for linear amplifier, IF OUT, RTTY, and XVTR.
- Handy phone patch IN and OUT terminals*

*Also available, the VFO-820 . . . the perfect companion to the TS-820.

NOISE BLANKER • The TS-820 uses an efficient noise blanker circuit, another Kenwood exclusive. A special crystal filter assures unsurpassed efficiency in eliminating unwanted pulse noises.

RF MONITOR • Built-in monitor circuit allows you to hear your own voice by sampling the RF signal. Especially useful for adjusting the RF Processor.

HIGH STABILITY VFO • The VFO, heart of any SSB transceiver, is an exclusive Kenwood design using FET technology.

DIGITAL HOLD • A single pushbutton switch offers the operator unprecedented versatility. The digital hold circuit will lock the counter and display at any frequency, but will allow the VFO to tune normally. Ever wanted to return to a certain spot on the band and forgotten the frequency? That won't happen again with the new digital hold feature on the Kenwood TS-820.

SPEECH PROCESSOR • An HF circuit provides quick time constant compression using a true RF compressor as opposed to an IF clipper. Amount of compression is adjustable to the desired level by a convenient front panel control.

IF SHIFT • The IF SHIFT control varies the IF passband without changing the receive frequency. This "IF shift" control is located on the front panel and provides excellent unwanted signal reject control or "pass band tuning." The 820 moves the signal across the IF pass band not the pass band across the signal.

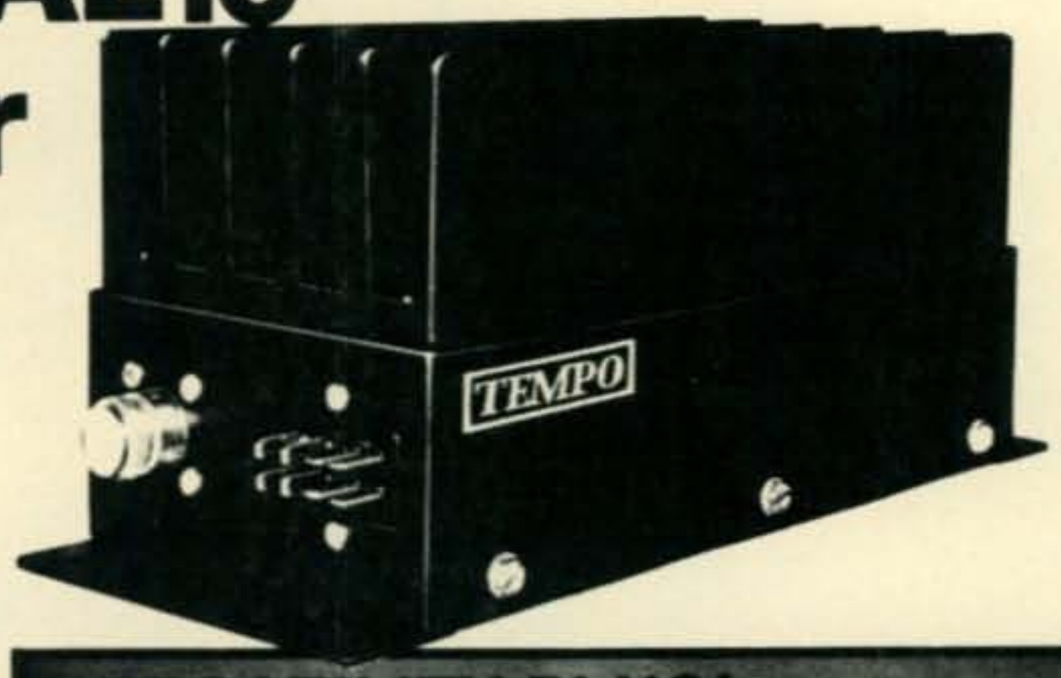
RF ATTENUATOR • Easy, one touch activation of the attenuator supplies 20 dB of padding on receive.

VOX • A voice-activated microphone circuit is built into the TS-820 with VOX GAIN, ANTIVOX, and VOX DELAY controls placed on the front panel for convenient adjustment any time.

KENWOOD
. . . pacesetter in amateur radio

If you own a VHF ONE, a TS-700A or an FT-221

...Tempo's 100AL10 solid state linear is just what you need



Double your pleasure with the first truly linear solid state power amplifier available. The 100AL10 guarantees increased range and clarity in your VHF communications under all operating conditions. It operates in the frequency range of 144-148 MHz with power output of 100W (nom) with 10W (nom) in. Modern solid-state technology is used throughout, along with conservatively rated components to assure the highest possible reliability. Microstrip design on glass epoxy circuit boards give added resistance to damage from shock or prolonged vibration.

Simply plugs into any of the above transceivers (an SSB adapter is required with the VHF-ONE) and you're on the air . . . loud and clear.

The 100AL10 (12VDC) $179.00
The PS-1220 (AC power supply) $129.00
The 100-AL10-B (AC power supply and amplifier in one compact package...ready for AC operation) $295.00

VERSATILITY PLUS! the TEMPO MR-2

VHF HIGH BAND MONITOR-PAGING RECEIVER

The Tempo MR-2 is a shirt pocket size monitor-paging receiver with hundreds of uses. 12 channel capability...more than any competitive receiver and at an economical price. Excellent selectivity and guaranteed sensitivity across a 4 MHz band spread. 140-170MHz range. Plug-in crystals. Ni-cad batteries and accessory charger included. $79.00 Commercial model ... $89.00

The Tempo Line, now more than ever...solid value

Tempo VHF-ONE Full 2-meter band coverage (144 to 148 MHz for transmit and receive • Full phase lock synthesized (PLL) • Provision for accessory SSB adaptor • 5-digit LED receive frequency display • Automatic repeater split • Solid state • 10 watts output . . $495.00

Tempo SSB ONE SSB adaptor for the Tempo VHF-ONE • Selectable upper or lower sideband • Noise blanker built-in • RIT and VXO $225.00

Tempo/CL-146A A mobile transceiver for the 2 meter amateur band • Compact and rugged • Solid state • 144 to 148 MHz (any 2 MHz without retuning). 12 channel possible. One channel supplied, two channels of your choice free $239.00

Tempo CL-220 Same general specs as CL-146A, but operates 220 to 225 MHz (any 2 MHz without returning) $299.00

Tempo FMH Two watt VHF/FM hand held • 6 channel capability • Solid state • 144-148 MHz • Includes 1 pair of crystals, built-in charging terminals for ni-cad batteries $199.00

Tempo 6N2 Power amplifier for 2 and 6 meter operation • 2000 watts PEP input on SSB & 1000 watts input on CW and FM •
Solid state power supply $795.00

Tempo 2002 For 2 meter operation $695.00

Tempo 2006 For 6 meter operation $695.00

Tempo VHF/UHF Amplifiers A wide range of solid state power amplifiers for use in most land mobile applications.

New from Tempo

Watch for the announcement of Tempo's brand new advanced design digital display transceiver...the Model 2020. 80 through 10 meters, SSB. Another solid value in the Tempo line.

Henry Radio

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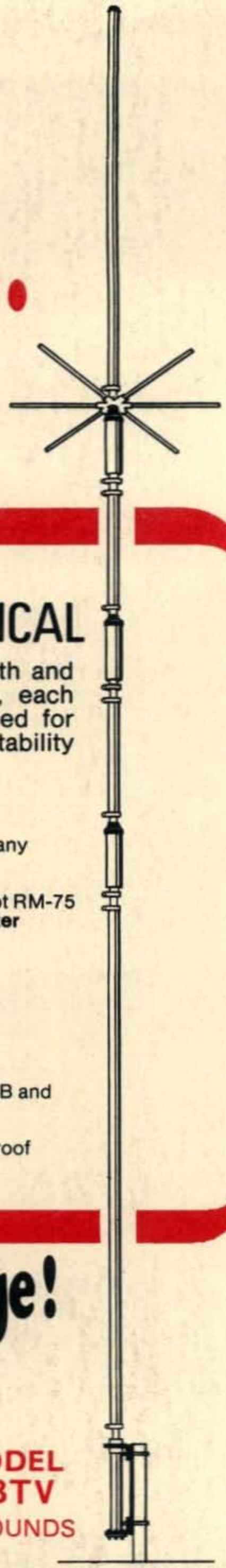
if the 4-BTV weighs 39% more... what do others leave out?



HUSTLER FIXED STATION FOUR BAND VERTICAL

The 4-BTV is longer for greater aperature, larger in diameter for strength and bandwidth, heavier traps for precision and safety factor. Individually, each subassembly weighs more to collectively give you an antenna designed for convenience of assembly and installation, a wide margin in mechanical stability and far superior electrical performance.

- **Lowest SWR**—PLUS!
- Bandwidth at its **broadest!** SWR 1.6 to 1 or better at band edges.
- Hustler exclusive trap covers **"Spritz" extruded** to otherwise unattainable close tolerances assuring accurate and permanent trap resonance.
- Solid one inch **fiberglass trap forms** for optimum electrical and mechanical stability.
- Extra heavy duty aluminum mounting bracket with **low loss—high strength** insulators.
- All sections **1¼" heavy wall,** high strength aluminum. Length 21'5".
- **Stainless steel clamps** permitting adjustment without damage to the aluminum tubing.
- Guaranteed to be **easiest assembly** of any multi-band vertical.
- Antenna has ⅜"-24 stud at top to accept RM-75 or RM-75-S Hustler resonator for **75 meter operation** when desired.
- Top loading on 75 meters for broader bandwidth and **higher radiation efficiency!**
- Feed with **any length** 50 ohm coax.
- Power capability—**full legal limit** on SSB and CW.
- Ground mount with or without radials; roof mount with radials.

one setting for total band coverage!
40 THROUGH 10 METERS

HUSTLER ANTENNA PRODUCTS—for sixteen years—original designs—created and manufactured by American ingenuity, labor and materials—used by communicators throughout the world.

Hustler designs are patented under one or more of the following assigned to New-Tronics Corporation: 3287732, 3513472, 3419869, 3873985, 3327311, 3599214, 3582951

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MODEL 4-BTV
15 POUNDS

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Announcing

● **Rome, N.Y.** — The Rome Radio Club will hold its 24th annual Ham Family Day on Sunday June 6 at the Beeches Resort Restaurant and Motel. Gate opens at 7 a.m. Features include talks, contests, ladies and childrens programs, flea market, and displays. For additional information write: Rome Radio Club, P.O. Box 721, Rome, N.Y. 13440. or call (315) 337-2622.

● **Shaker Heights, OH** — The Midwest Alliance of Computer Clubs is sponsoring its first annual Computer Convention on June 11-13 at the Stouffer Somerset Inn, 3550 Northfield Rd. in Shaker Heights. Features include: Computer products, displays, Large Flea Market, Technical sessions, Computer demonstrations and games. Tickets are $2.00 at the door, refreshments available. For further information, write: The Midwest Alliance of Computer Clubs P.O. Box 83, Brecksville, Oh. 44141.

● **Black Hills, S.D.** — The Black Hills A.R.C. will be operating a bicentennial special events station (NSØDAK) at Mt. Rushmore National Memorial, in the Black Hills of South Dakota, on July 3rd-5th. SSB and CW on general and advanced portions of 80 thru 10 M and 2 M FM. Special QSL cards will be available. Please QSL with s.a.s.e. to KØCXL at 715 San Marco, Rapid City, S. Dak. 57701.

● **Santa Maria, CA** — The Satellite Amateur Radio Club is sponsoring the Santa Maria Amateur Radio Picnic and Swapfest to be held on Sunday, July 11th, beginning at 12 noon at the Newlove - Union Oil Picnic grounds on Orcutt Hill. Watch for the signs marking the turnoff 1 m South of Clark Ave. on US 101. Talk in will be on 146.52 and 7280 kHz. Santa Maria Style barbecue at 2:30 p.m. All the food you can eat. Door prizee is a Tempo One 80-10 Meter transceiver. Swap tables abailable at $3.00 each. Tickets are $5.00 for adults, $2.50 for under 12 and can be obtained by sending a check made out to Santa Maria Swapfest, Route 1 Box 55A, Santa Maria, Ca. 93454.

● **Palmyra, IL** — The Quad-Co. Amateur Radio Club, Inc., will sponsor the 19th Annual Hamfest of the "Breakfast Club" on July 17 and 18 at Terry Park, 3/4 mile east of Palmyra, 111. Saturday night activities include dancing and movies. Sandwiches and soft drinks available. Mobile talk-in on 3973 Kc. Games, contests golfing and fishing. Bring your swap gear. Camping facilities open from Friday afternoon until Monday morning. Pre-registration is $1.00, $1.50 at gate. Write: "Hamfest", c/o Quad-Co. ARC, Box 81 Chatham, IL 62629.

● **Portage, IN** — The Lake County Amateur Radio Club's 2nd annual hamfest is July 18 at the Issac Walton League. Take I 94 to Ind. 249 exit, then north on Ind. 249 1/2 mile. Tickets $1.50 advance, $2.00 at the gate. Write Herbert S. Brier, W9EGQ, 409 S. 14th St. Chesterton, In. 46304.

● **McKeesport, PA** — The Two Rivers Amateur Radio Club announces its 12th Annual Hamfest on Sunday, July 18th. at the Green Valley Fire Department fair grounds off U.S. Route 30 near East McKeesport. Large Flea market. For more information write: Two Rivers Amateur Radio Club, Inc., McKeesport, PA.

● **Slater, MO,** — Antique Aircraft and Amateur Radio Show Saturday and Sunday, July 24 and 25, at the Slater Memorial Airport. Registration $1.00 in advance: $1.50 at the door. Buffalo burger feed Saturday night and Sunday noon. Talk-in 3963 KHz, 146.94 and 146.28/.88. For additional information and advance tickets write Dale Beilsmith WØKNF, 807 North Broadway, Slater, MO 65349.

● **Crossville, TN** — The Oak Ridge Amateur Radio Club, Inc. Annual Crossville Hamfest will be held on July 24-25 at the Cumberland County Fair Grounds. Technical forums, Banquet, Breeder Reactor Program planned, picnic, flea market, raffle of many valuable prizes, and "eyeballing your friends" at the Fair Grounds. For more information contact: The Oak Ridge Amateur Radio Club, Inc. P.O. Box 291, Oak Ridge, Tn. 37830.

● **Flagstaff, AZ** — The Ft. Tuthill Hamfest is being held July 30-31 and August 1 at Coconino County Fair Ground - Across I-17 from Airport. R-V and Tent camping. Swap meet, Tech sessions, Contests, Prizes, Pot Luck, Exhibits, Talk-in on 146.22/82, 146.34/94, 146.52 and 3992 KHz. For more information contact: Merle Hutton, WA7JCK, 2549 E. Richards Place, Tucson, AZ 85716.

● **Norfolk, VA** — The ARRL Roanoke Division Convention & Tidewater Hamfest will be held on July 31-Aug. 1, at Norfold Scope. Exhibitor Display and Flea Market, completely Indoors and air conditioned. ARRL Banquet. For more information write: Tidewater Radio Conventions, Inc. Box 9371, Norfolk, Va. 23505.

● **Pasadena, CA** — The Jet Propulsion Laboratory Amateur Radio Club (JPL-ARC) will be conducting one of its active participation programs for this year by making contacts with other Amateurs all over the United States and many foreign countries in conjunction with the Bicentennial project of landing on Mars. The JPL-ARC will be "On the Air" during the Mars encounter by the Viking I and Viking II Spacecraft. The JPL-ARC will be using the special call of N6V on the following frequencies, CW, 3530,7030, 14030, 21030, 28030 KHz, SSB, 3810, 3930, 7230, 14225, 14325, 21360, 28630 KHz, Novice CW, 3730, 7130, 21130, 28130 KHz. Approximated dates are: June 18-23, July 3-18, Aug. 6-12, Aug. 31-Sept. 15. For more information write: Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Dr., Pasadena, Ca. 91103.

● **Amherst, MA** — The New England Solar Energy Association announces its first annual conference and exhibition on June 24 and 25, on the campus of the University of Massachusetts. The conference will focus on the unique re-

(Continued on page 79)

Great cost cutting ideas we've rejected for 20 years

Unplated hardware. We use a nickel-chrome plating that defies corrosion.
Cheaper stainless steel. Our 17-7PH steel whips bend 180° and return to perfect vertical.
Erratic coil winding. Tight, precisely wound coils are vital to maximum range.
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ARRL ATLANTIC DIVISION CONVENTION

JULY 23, 24, 25

BEN FRANKLIN HOTEL, PHILADELPHIA

BICENTENNIAL AMATE

WILL BE YOUR VISIT TO HAMTRONICS BICENTEN

$10,000 in Han

Just register --- you don't have to be present to win! All prizes wi be awarded. YAESU 101E, KENWOOD QR666, DRAKE TR-22 STANDARD SRC-851T, MIDLAND 13-509, HI GAIN H-1 QUA CUBICAL QUAD, HALLICRAFTERS HA-20, JOHNSON 2 WATT MATCH BOX, ATLAS 210X, GALAXY RV 550, CLEG HT-146, CDR HAM/II, and many, many more prizes.

- EXTRA --- hourly drawings. More fabulous goodies will b given away at the Hamtronics Show Room every hour on th hour! We'll just keep pulling names until somebody prese wins!
- FREE BUS SERVICE from Ben Franklin Hotel to our door with a stop for the ladies (if they so desire) at the magnificen all-enclosed NESHAMINY MALL, just a few minutes awa from Hamtronics.
- FREE REFRESHMENTS, FUN, PRIZE AND FREE GIFT FOR EVERYONE who comes to Hamtronics during our B centennial Convention/25th Anniversary Jamboree.

HOURS:

Thursday, July 22, 1976 --- 9 AM to 9 PM
Friday, July 23, 1976 --- 9 AM to 9 PM
Saturday, July 24, 1976 --- 9 AM to 6 PM

HAMTRONICS

THE HIGHLIGHT OF YOUR TRIP TO THE

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ARRL CONVENTION/SILVER ANNIVERSARY JAMBOREE!

Goodies as Prizes!

MORE HAM EQUIPMENT than you can see on display anywhere in the world! ($1,000,000 inventory.)

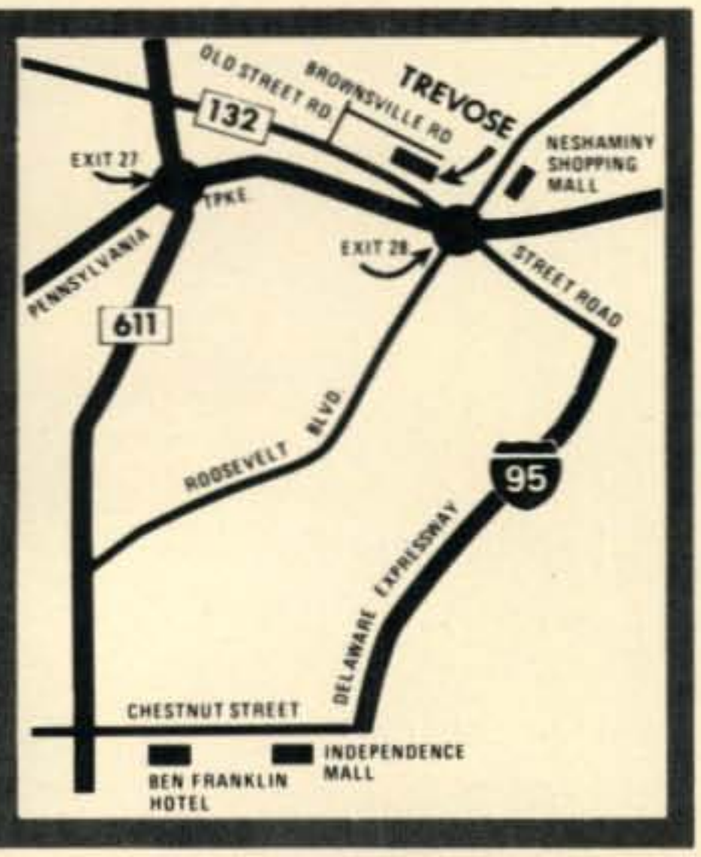
NO BICENTENNIAL TRIP TO PHILADELPHIA is complete without a trip to Historic Bucks County. (Washington crossed the Delaware to surprise the Hessians at Trenton, from a point nor far from Hamtronics Showroom.)

WHY ISN'T HAMTRONICS EXHIBITING AT THIS ARRL CONVENTION?

With our air conditioned showroom only a scant 10 air miles from Center City, we felt it would be easier for you to come to us. After all, we could display only a small fraction of our million dollar inventory on the convention floor. Besides, we are eager for all hams to see our showroom and get acquainted with all of our people.

HERE'S HOW TO GET TO HAMTRONICS BY AUTOMOBILE

FREE PARKING (our lot holds 200 cars)



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The challenge and excitement of travel plus the thrill of operating from remote areas can sometimes be satisfied not too far from home.

A CANOE, A PM2B, ES QNI QTC QRPp 9/0

BY RAY SOMMERS, WB9LKC

April 12, 1974: CQ de WN0JDI and my first QRPp contact using a Ten Tec PM2B with a little over one watt input. A ten minute QSO with a whopping RST of 239/QRM/QRN. The QRPp bug had bitten.

Original plans were to use the lil rig on camping trips and ultimately on one of our canoe trips into the Boundary Waters Canoe Area (BWCA) in Northern Minnesota. But would contacts be possible or would the rig turn into excess baggage? No fun portaging extra weight.

WB9LKC/4

With a three week technical session at Oak Ridge, Tennessee coming up in the summer of 1974 a carrying box was constructed for the rig and again the question of whether it was worth taking arose. 68 contacts on Field Day indicated it was. The box contains the rig, two 6 v. alkaline rechargeable batteries, antennas, tuner, s.w.r. bridge, log, paper, candles, etc., etc., and when full weighs 25 pounds. A convenient feature is a jack and switch which allows the rig to be run off the car battery or the internal batteries to be charged from the car. The straight key is permanently mounted on the fold down front which serves as a writing surface.

Three weeks of tenting at Cove Lake State Park in Tennessee and spare time operation on 40 meters netted 25 QSO's in 13 states with 529 to 589 reports. A success!

WB9LKC/8

The acquisition of an Argonaut somewhat cur-

The portable carrying box of WB9LKC.

Ray, WB9LKC/Ø making a WX report at Snipe Lake.

tailed PM2B operation but occasionally the lil rig was fired up to see if it still worked. With a week vacation in late May 1975 plans were made for a short trial canoe trip with the rig. This was the Sylvania Recreation Area in Michigan, just north of Land O' Lakes, Wis. There was only one short portage so the extra weight was acceptable.

Because the antennas would be strung up in the trees new ones were made. 80, 40, and 20 meter dipoles were made using insulated #20 stranded wire and only a center insulator. No end insulators were used so that the wire could be easily pulled through brush and trees. Instead an overhand knot in the wire was used to connect it to the ropes. Well, almost rope. Nylon twine about the thickness of store string was used. The feed line was aluminum coax fitted with alligator clips in order to facilitate the frequent putups and takedowns.

Having become a member of four of the Wisconsin nets (with QRPp) I hoped to send messages to the XYL at the home QTH. The s.s.b. nets were warned of a possible QRPp c.w. BK.

What a place for an antenna—tall maples with almost no underbrush. Using a rubber ball as a weight so it wouldn't clobber someone on a miss, the twine went up and over a limb. It was a miss but went ten feet higher than planned and over a small twig, up about 35 feet or so. Just great! Five days resulted in 15 QNI's on 80 meters, 5 messages sent and 1 received, and 8 other QSO's, 4 being on 40. May 28 was a great day with QNI's in 6 of the 7 Wis. nets. Just couldn't get up for the one at 6:45 a.m. Needless to say some QNI's were relayed in. Boy was K9CPM ever strong and with good reason. I later found that his QTH was only about 20 miles away as the crow flies.

The mosquitoes were ferocious with the result that the operation was conducted on the floor of the tent and more time was spent on the rig than planned. Just try sending when sitting on the floor. kneeling, crosslegged, lying down,—nothing was comfortable. By the time I returned home however, I was so conditioned to it that I could barely operate at my desk.

WB9LKC/Ø and the BWCA

The BWCA is a roadless area and part of the Superior National Forest. It adjoins a similar area in Ontario called the Quetico Provincial Park. The first trip up there was about 25 years ago when we learned the lesson of taking only what you need and that better not weigh too much. No problem when the gear is in the canoe but portaging makes one wish the extra junk was somewhere else. Our sixth trip up there was planned for August 1975 and by now there was little question that the rig would go. Still, would QSO's be possible? The trees in this area are mainly conifers and any place away from the small campsites there is heavy underbrush.

The kids look forward to dinner beside Snipe Lake.

Stringing an antenna would be a real challenge.

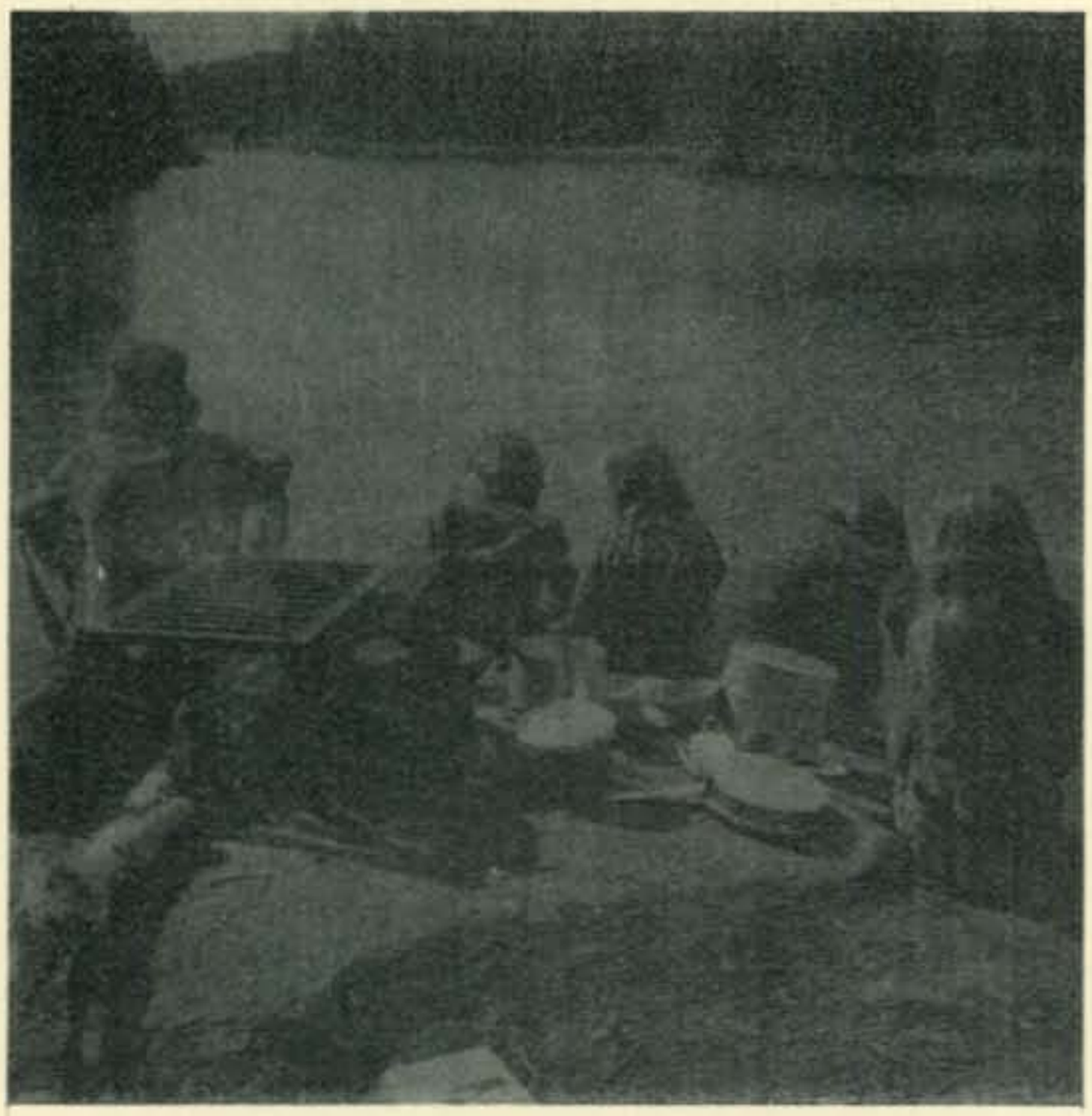
The trip would start at Round Lake about 40 miles north of Grand Marais and would last about two weeks. That's about 80 pounds or so of food for myself and 6 children aged 9 through 15 (they eat more than I do as I was to find out). The food was always strung up between trees as far as possible in order to protect it from "things that go bump in the night."

August 11: 12 hours of driving.

August 12: After paddling and portaging, paddling and portaging, four times, we camped on Flying Lake.

August 13, noon: Badger Emergency Net (BEN), BK de WB9LKC/0 . . . W9MMP/0 this is K9CPM

The chef checks out the fire.



Dinnertime at the big rock at Snipe Lake.

"you've got a c.w. breaker in there." Wow, I made it on the first try—with a little help!

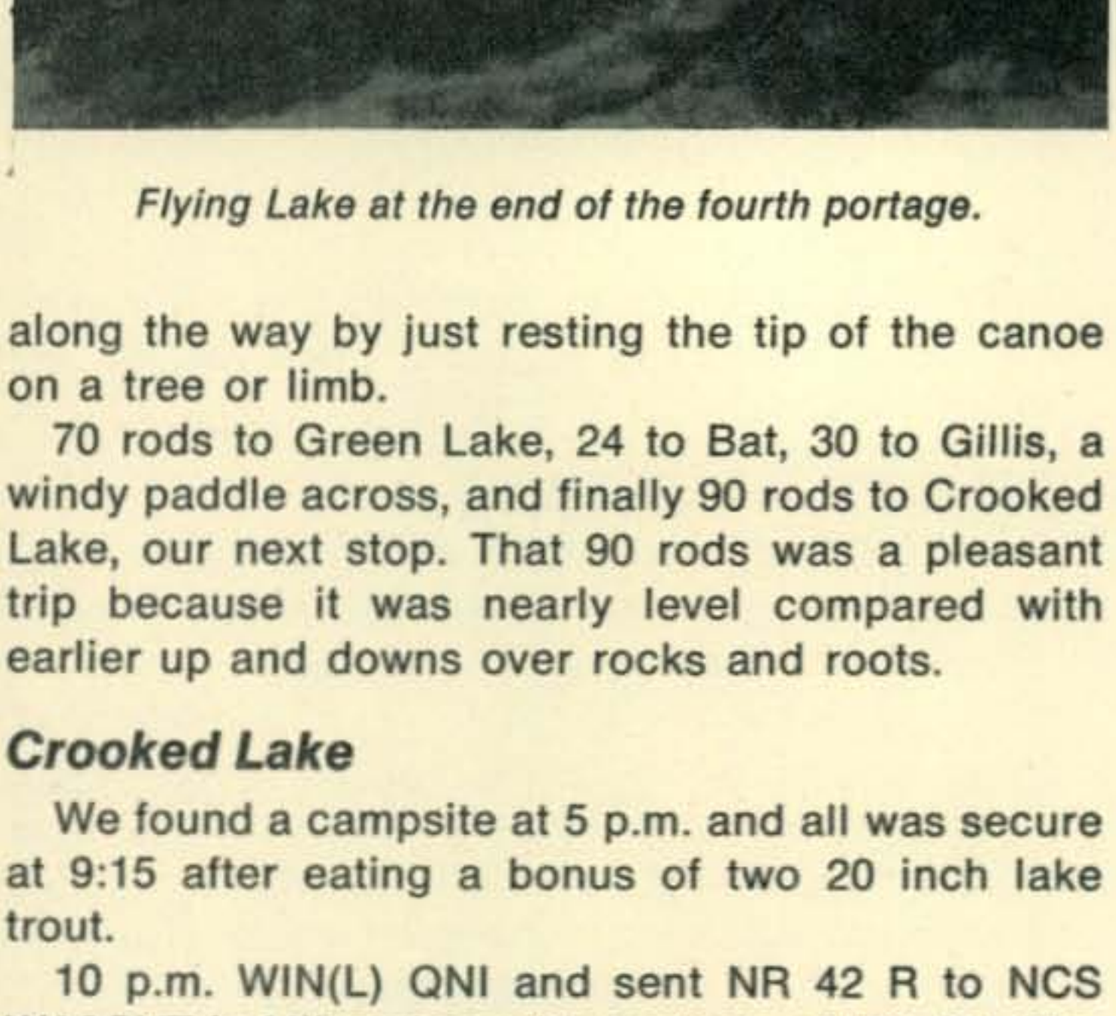
5:30 p.m.: Wis. Sideband Net (WSBN), NR 41 R relayed by K9CPM "ON FLYING LAKE X RAINED AND QUITE WINDY X PORTAGES TOUGH AND AM GETTING OLD X MOVE FRIDAY X LOVE BT RAY" AR

7:00 p.m.: Wis. Intrastate Net Early (WIN E), QNI

10:00 p.m.: WIN(L) by candle light, no one heard me.

The antenna site wasn't too bad here since we were on the south side of a small island. With limited feedline there was just barely room to get the 80 meter dipole up. The center was about 15 feet and the ends about 4 feet off the ground and about 10 feet from the shoreline. Just south across a small stretch of lake was a big mean hill which was to be the next portage when we moved on. Looks like QRPp might make it.

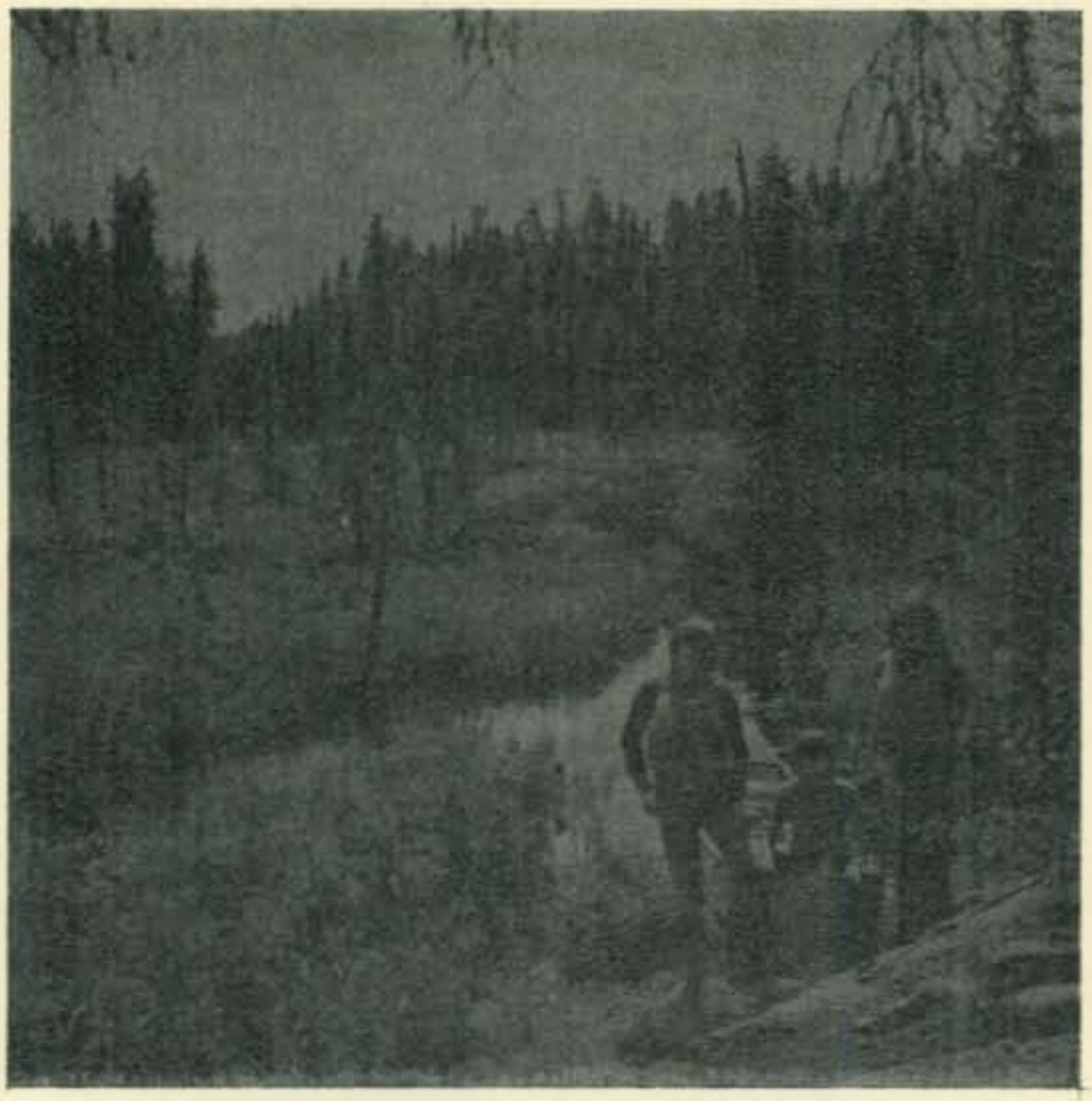
August 14: After breakfast we fed a duck a few minnows the children had caught and then it tried sleeping on a rock balanced on one leg. Enough fooling around, there's work to be done today! We broke camp and were on our way up and down across that hilly portage. The canoes weigh in at about 75 pounds and with a one-man carry they pinch the neck muscles in no time at all. There are occasional canoe rests made from logs by the Forest Service but we made numerous other stops



Flying Lake at the end of the fourth portage.

along the way by just resting the tip of the canoe on a tree or limb.

70 rods to Green Lake, 24 to Bat, 30 to Gillis, a windy paddle across, and finally 90 rods to Crooked Lake, our next stop. That 90 rods was a pleasant trip because it was nearly level compared with earlier up and downs over rocks and roots.



Taking a break on a portage into Flying Lake.

Crooked Lake

We found a campsite at 5 p.m. and all was secure at 9:15 after eating a bonus of two 20 inch lake trout.

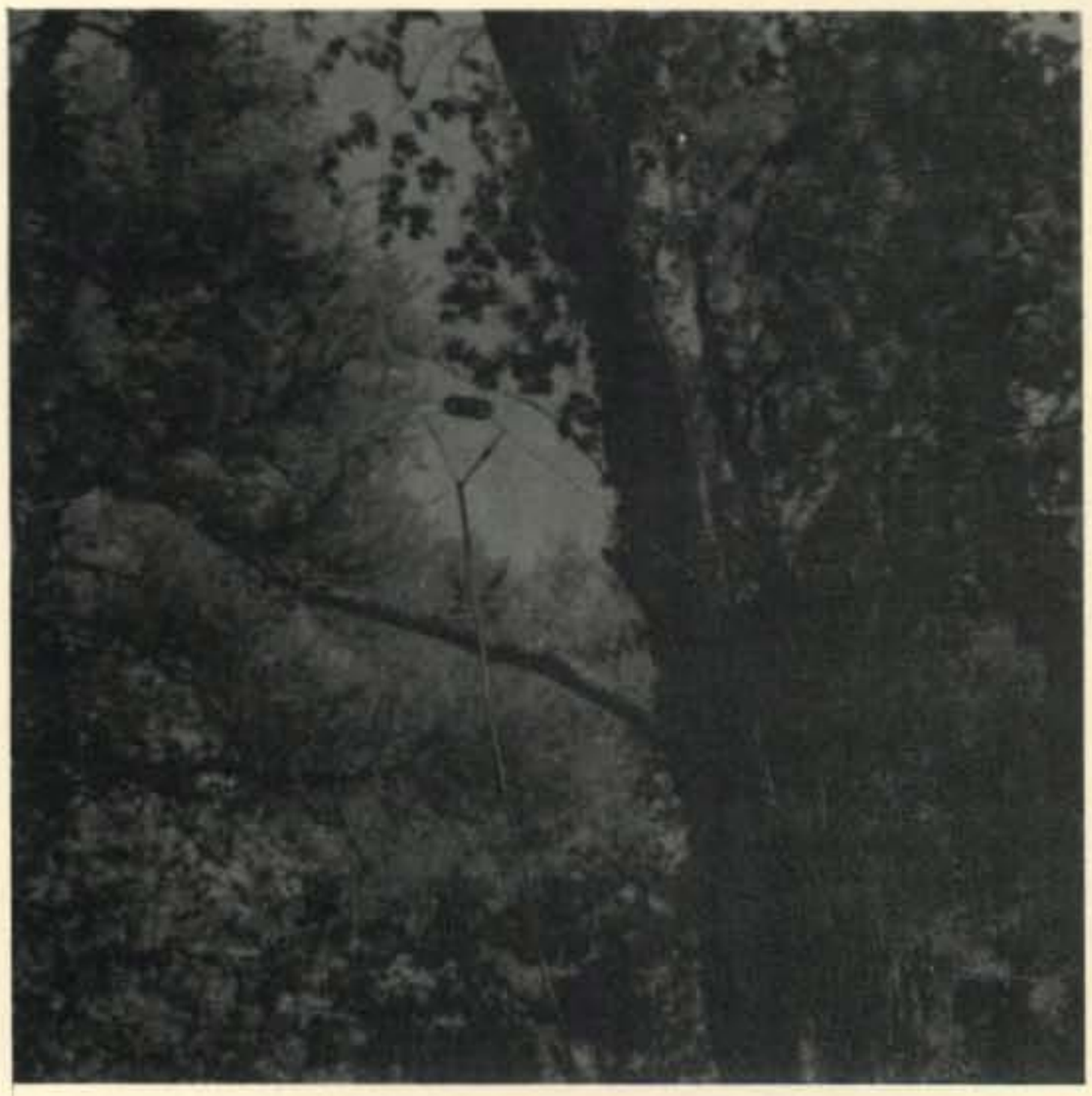
10 p.m. WIN(L) QNI and sent NR 42 R to NCS WA9QVT in Milwaukee with the help of K9LGU. The message was delivered a few days later mainly because the home QTH is in the fone area of only five stations who QNI the various nets. After hearing the

message in the system 3 days later and decision was made to list traffic only if someone was on who could deliver it. No use making a pest of myself. For every message sent two or more were ready but were not sent for this reason.

August 15: Light rain but trout for breakfast started the day off right. Noon BEN QNI QTC Custer —NR 43 R relayed by K9CPM and delivered a few minutes later by W9CFS. Now that's the way it should work! Actually, as I found out later, W9CFS was able to copy the message directly.

WSBN QNI, WIN(E) no luck, WIN(L) QNI QTC but poor conditions so QTA.

Crooked Lake has crystal clear water and our site was about 30 feet above the lake level. At first we didn't like climbing the hill every time to the

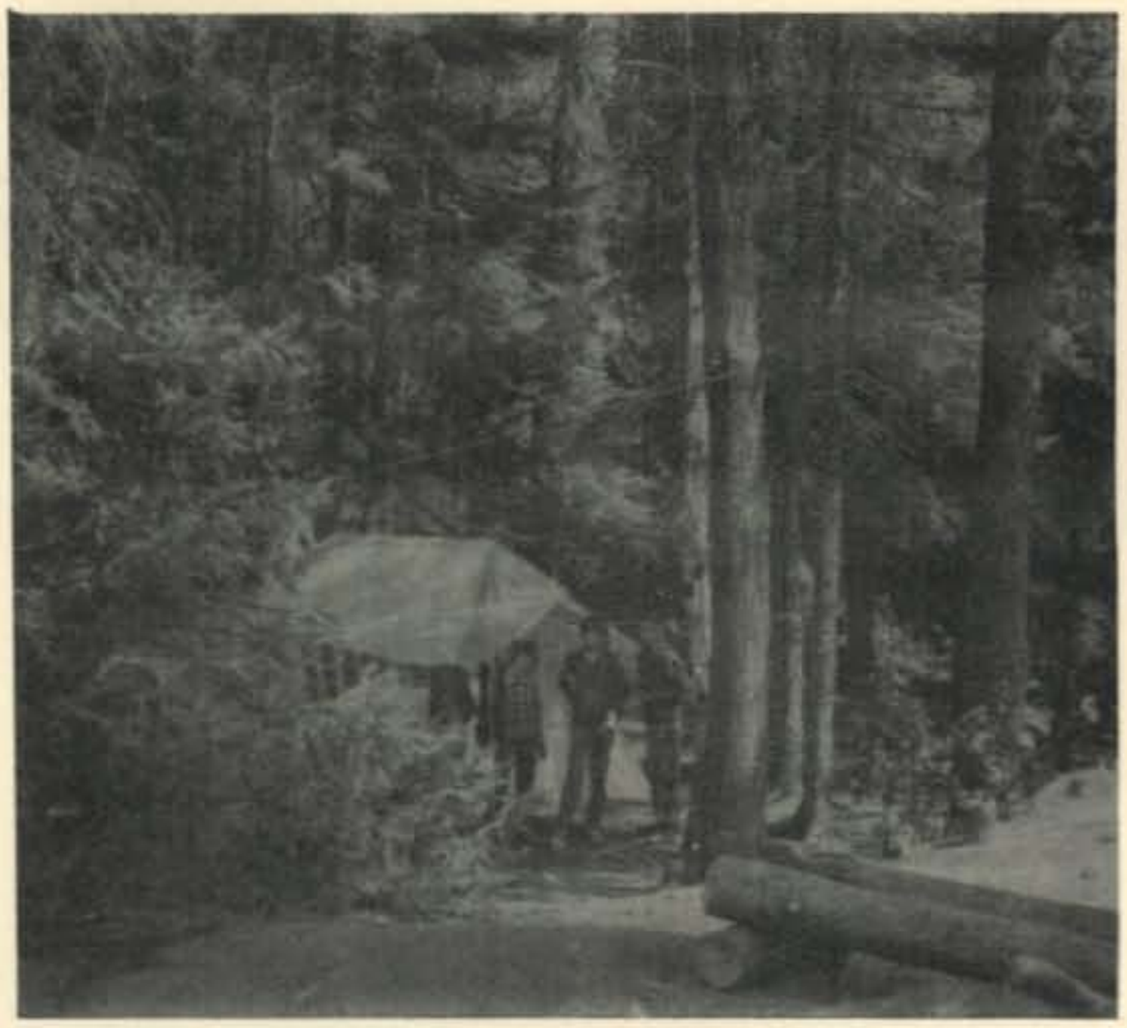


The Flying Lake "feedpoint."

tent site but the location for the antenna was the best we would have. We were on a point of a large island about a half mile long and could see east, west, and south. The area around the tent was quite clear and I got the antenna up about 25 feet.

August 15, 16, 17, 18, and still here. The loons were spectacular. Crying, laughing, doing gymnastics for us, diving, shaking their wings and walking on the water—what a show. Because of the trouble they have in getting airborne we sometimes saw them go over a quarter of a mile sort of skipping along and using their wings like canoe paddles. It made quite a racket and we would hear them before we'd see them. One loon had a fish about a foot long and it took about 20 minutes until he managed to get it down.

12 QNI's while on Crooked Lake and sent 4 messages. Also had a QSO with WB9ICH after WSBN



The campsite at Flying Lake with the antenna in the foreground.

and with WNØPHK/Ø on 40 meters but he had rough copy.

Snipe Lake

August 19: Off again and on a rare calm day when everything is reflected in the mirror surface of the lake. To a canoeist, this must be what Heaven is like. Through Owl, Tuscarora, Howl, Hubbub, Copper, and on to Snipe our new home. But something was funny after that 255 rod portage (0.8 mile) from Tuscarrora. The lake didn't have the right shape for Howl according to the map. It wasn't Howl Lake! The long boardwalk through a swamp was where Howl used to be. Guess the beaver dam

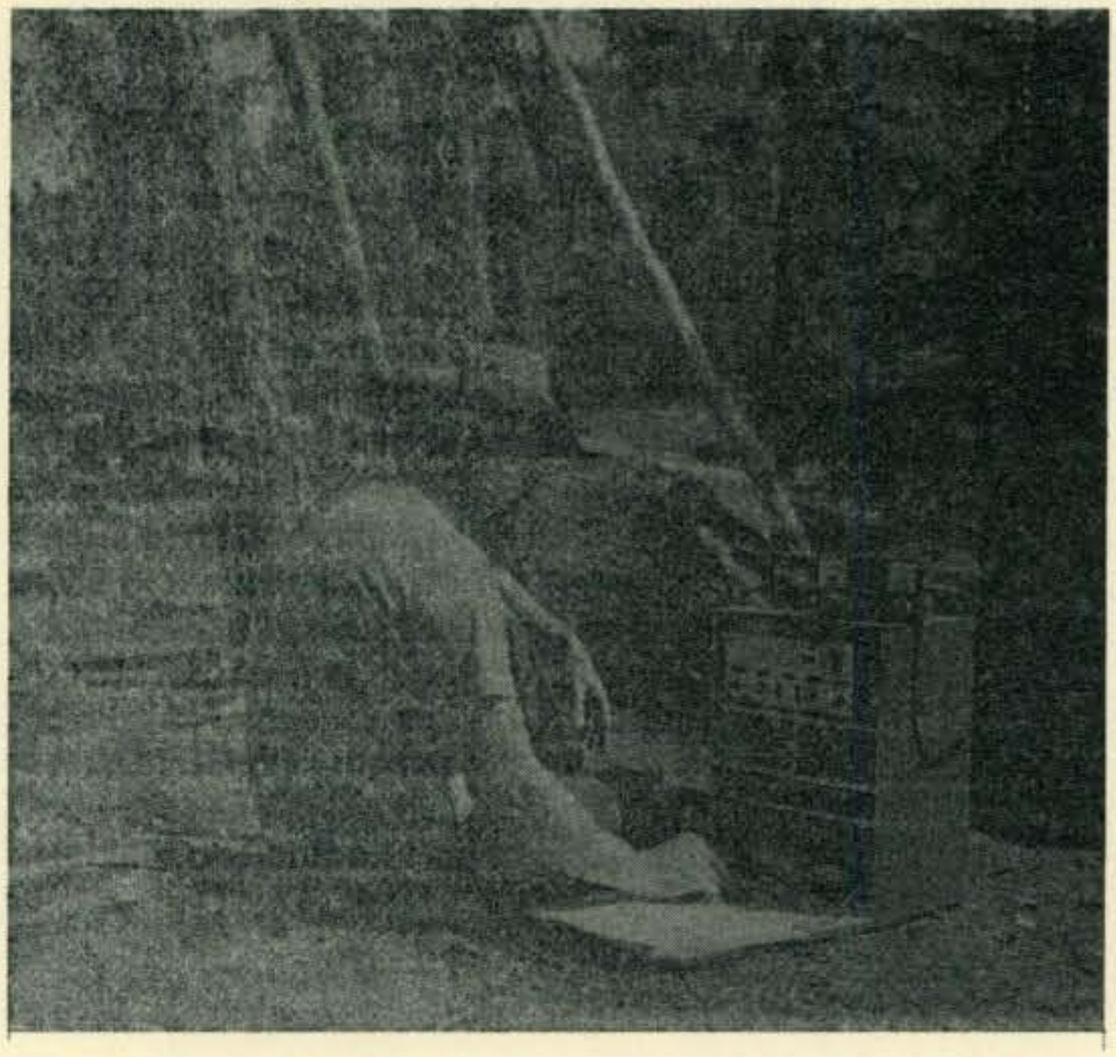
One operating position in the tent.

Morning on Crooked Lake.

holding the lake back must have given way some years ago. It reminded me of the story about two canoeists getting up one morning to find the lake gone. No one said anything about it for quite some time because each one thought he had gone off his rocker! Anyway we were happy to miss a lake and a portage.

Snipe Lake is a many armed lake and fairly narrow although its long arms give it a nice size. The water was no longer clear but now had the light brown color and taste typical of many rivers. No loons or lake trout here but a 34 inch northern pike provided a good meal.

There are four campsites here but only one had a tent site anywhere near big enough for our 9 × 12 tent. It looked bad for rain because the rain would run off the tent fly onto a very large rock right back to the tent. Maybe the long dry spell would hold a few more days.



Ray, WB9LKC/Ø listening for DX at Crooked Lake.

WIN(L) and NR 46 via WA9QVT to W9BCC who delivered it. Normally the net finishes its business by 10:30 p.m. but it took until 11:05 for them to QSL my message. With such effort to handle just a routine message I have no doubt about getting an emergency message through if the need should ever arise.

The antenna site was about the worst possible. We were on the north side of a very large hill right at lake level. Heavy brush and trees limited the center height to only 15 feet.

August20: Two QNI's relayed. Then about 8:30 p.m. the first big rain storm of the summer hit. As suspected we were in a poor spot. About 1 a.m. some rain was seeping into the tent from the floor and one could feel a nice water bed of one to two inches of rain under part of the tent. It took two days before it had seeped away enough for us to use that side of the tent. Damp sleeping bags—ugh.

August 21: heavy QRN and no QNI's.

August 22: Tried loading up the 80 meter dipole on 20 and with the tuner got the s.w.r. to nearly 1:1. CQ de W6MSR . . . W6MSR de WB9LKC/Ø . . . WBLKC/Ø de W6MSR ur RST 449 Sunnyvale... ... SRI OM CAN'T CPY CUZ OF QRM. Wow. Not much of a ragchew but I'm still amazed he even got my call on the first go around. Two more QNI's but conditions too poor for QTC.

August 23: Another heavy downpour and more water in the tent delayed our planned return. Two more QNI's and NR 47 delivered by W9MFG. WIN (E) heavy QRN and no QNI. But after net W9BCC called and asked for any message. We tried for over an hour and were just about to adjourn to 15 minute skeds when an opening came through and "go now." Message passed and delivered to XYL and answer received on WIN(L).

Homeward Bound

August 24: Heavy fog and mist and a tail wind resulted in fast paddling through Crossbay and Ham Lake. After a mile walk to the car and 20 minutes of coaxing a thoroughly soaked engine, we were on our way.

First fog, then lightning, rain, and wind -the worst storm of the summer accompanied us on the 11 hour drive home. 2 a.m. and a half mile to go found the road blocked by a large tree. A detour brought us home to find another tree down in the yard and on top of a shed. Wonder how the tent would have survived this?? Boy those prayers for rain sure ended the drought!

(Continued on page 68)

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CQ Reviews: The Heathkit HW-2021 Hand-Held 2-Meter Transceiver

BY HUGH R. PAUL, W6POK

Now that Spring has arrived, most amateurs will be spending less time in the shack and more time indulging in outdoor activities. If you are planning some weekend jaunts or the annual vacation trip, you would do well to consider taking your hobby with you in the form of a portable rig.

The Heathkit HW-2021 hand-held 2-meter transceiver. (Photo by Sandra K. Paul)

Two meter activity being what it is, a small hand held unit is ideal. Of the many units now on the market, one of the most attractive both for price and features is the Heathkit HW-2021. Weighing just two pounds, this little rig comes complete with a nickel-cadmium battery pack, a.c. charger and rubber duckie antenna. Options include a vinyl carrying case and touch tone encoder for use on repeaters equipped with Auto-Patch.

A single crystal controls both transmit and receive, which results in considerable savings if you buy as many crystals as I do. While provision is made for five channels, you actually have ten. The HW-2021 comes equipped with a —600 kHz offset crystal, which results in two transmit frequencies for each crystal. If you have repeaters in your area with non standard pairing, no problem. Merely change the offset crystal to one that meets your requirements.

Other features include a unique circuit to conserve battery power in the receive/standby mode by about 75% and a transmitter power output of 1 watt to either the standard antenna or an external one thru an auxiliary jack on the side.

The Receiver

The receiver circuitry of the HW-2021 is simple, but effective. Ten transistors and two integrated circuits are employed in a single conversion design. Another eight transistors are used in the receive/standby battery power conservation circuit.

Two dual gate MOSFET r.f. amplifier stages in cascade contribute greatly to the overall sensitivity figure of microvolts for 2 db of quieting.

The local oscillator stage uses fundamental crystals in the 15 MHz range. The output of the oscillator is multiplied thru two tripler stages and then injected into another dual gate MOSFET, which

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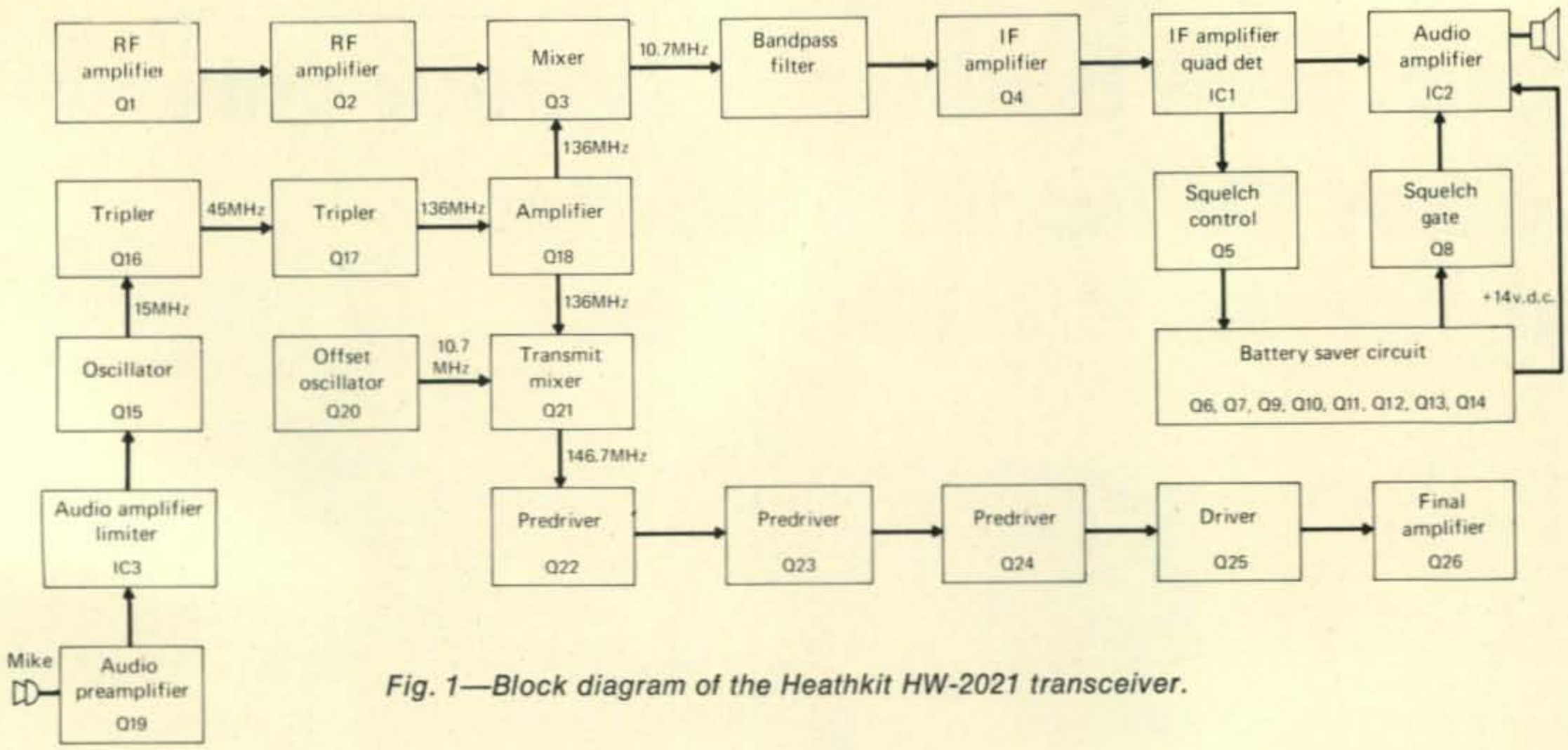


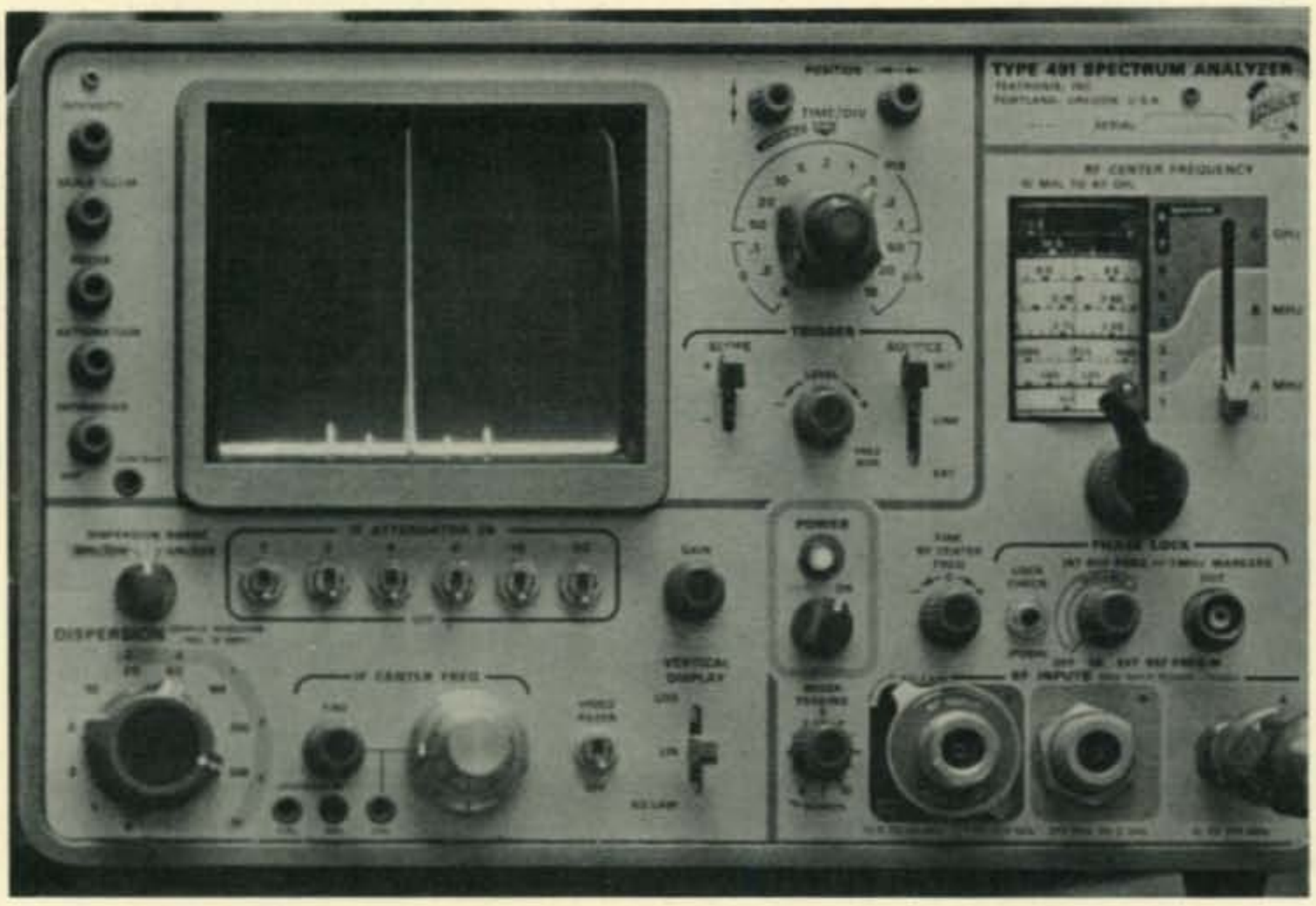
Fig. 1—Block diagram of the Heathkit HW-2021 transceiver.

functions as the mixer stage. The resulting 10.7 MHz i.f. signal then passes thru a bandpass filter, consisting of dual two section crystal filters. Bandwidth at the —6 db point is approximately plus and minus 15 kHz. At the —60 db point, the bandwidth is approximately plus and minus 30 kHz.

Intermodulation was experienced only from stations operating 15 kHz removed from the receive frequency. While receiver bandwidth specifications would lead you to believe that intermodulation would be a considerable problem, I found it to be no worse than some other units in the over $300 price class, currently being tested. Audio quality of the receiver is excellent. The IC audio amplifier is rated at .5 watts and is ample under most circumstances. Total harmonic distortion is below the 10% specified by Heathkit.

In recent weeks I have been plagued with a high noise level on the power lines in my neighborhood. In the course of "on the air" testing of various pieces of equipment, I have found that when operating from an a.c. supply this noise can make copy of the weaker repeater stations very difficult. I was pleased to note that the HW-2021 demonstrated greater immunity to this type of interference than some transceivers in the $400 to $500 price class. In mobile use the HW-2021 was a good performer with regard to impulse type ignition noise.

The battery saver circuit is very clever and is reproduced here for those of you who like to pick up on a good idea. With no signal to the receiver and squelch control R_{26} adjusted so that squelch is activated, the squelch control transistor Q_5 is conducting heavily, thus lowering the voltage on the



Spectrum analysis of the HW-2021. Two spurs are visable, one is the 10.1 MHz offset oscillator signal which is 30 db down from the carrier level and the other is a 5 MHz spur 35 db down from the carrier level. (Photo by Sandra K. Paul)

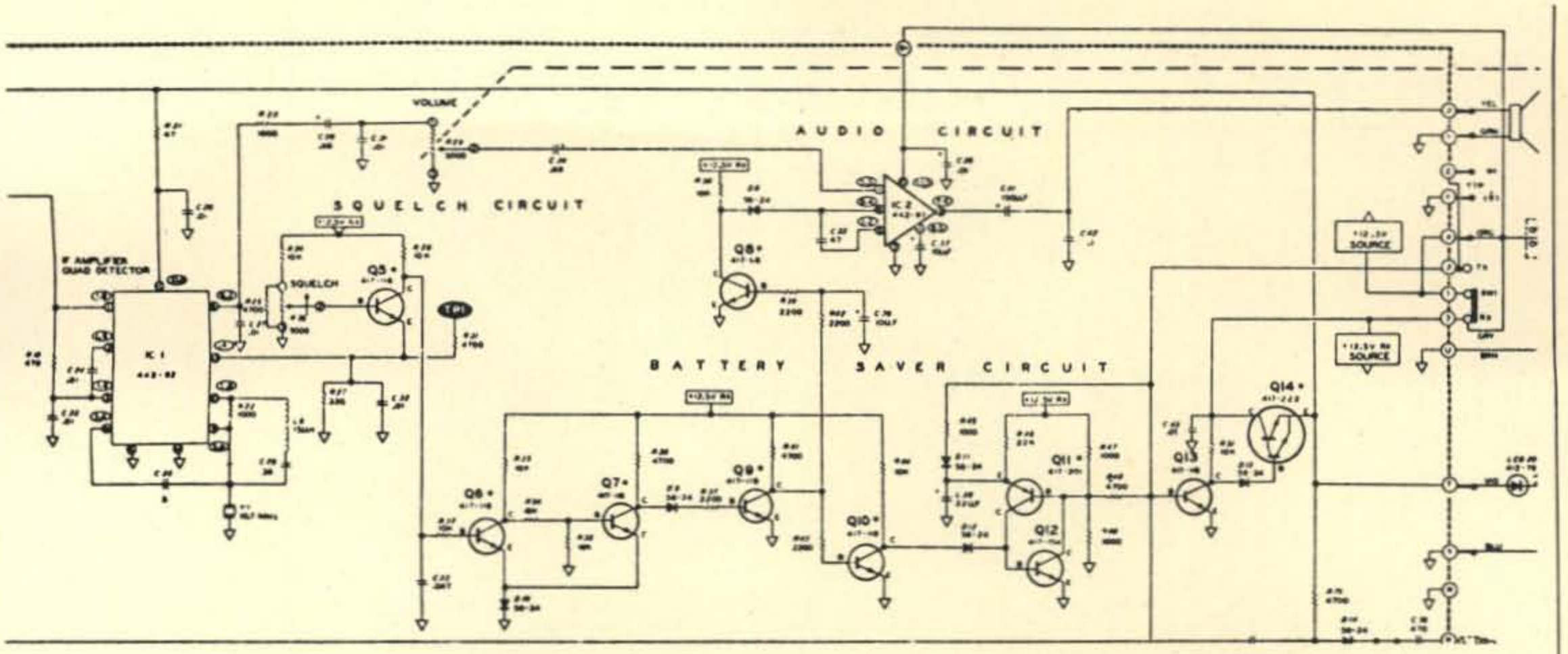


Fig. 2—Innovative battery saver circuit used in the HW-2021 as reproduced from the manual.

base of Q_6, which along with Q_7 functions as a Schmitt trigger. The output of the trigger circuit is low, thus the output from the d.c. amplifier Q_9 is high. The output of Q_9 is fed to the base of the squelch gate Q_8 and to the base of another d.c. amplifier Q_{10}, which in turn gates the pulse oscillator, consisting of Q_{11} and Q_{12}.

During the squelched condition, collector voltage on Q_{10} is low, thus transistors Q_{11} and Q_{12} produce a pulsed output voltage. Each pulse lasts about 20 ms. The R/C time constant being determined by resistor R_{45} and capacitor C_{39}. This pulsed voltage is applied to the base of buffer amplifier Q_{13}, then inverted to drive the switching transistor Q_{14}. The battery voltage present at the collector of Q_{14} is pulsed to the receiver, thus turning it on and off and conserving battery power in the process. The proper functioning of this circuit is indicated by the small LED on the front panel, just below the base of the rubber duckie antenna. The LED blinks "On" with each pulse of battery voltage.

The Transmitter

The transmitter employs the same oscillator and associated multiplier stages used in the receiver section. Modulation is direct f.m. achieved by a JFET audio pre-amplifier driving an IC amplifier/limiter, the output of which is applied to a Varicap diode in the 15 MHz oscillator circuit.

The modulated r.f. from the multiplier stages is mixed with the Offset Oscillator output in a dual gate MOSFET mixer stage. Three pre-driver and one driver stage provide about 50 milliwatts of drive to the final amplifier. The latter device being either a 2N5913 or PT8831. Power output with 13.8 volts applied measured 1.72 watt.

The spectrum analysis photograph shows a spur 10.1 MHz removed from the carrier frequency, which is 30 db down from the carrier level. This spur is the 10.1 MHz offset oscillator signal. The 10.7 MHz crystal for simplex operation was switched in and it too measured 30 db down from the carrier level.

Another spur approximately 5 MHz removed from the carrier frequency may be observed in the photograph. This spur is 35 db down from the carrier level and presents somewhat of a mystery to its origination. It appears to be unique to the unit under test. Other HW-2021's exhibit only the 10.7 MHz spur.

Audio quality of the transmitter is excellent. This due in part to the use of a separate microphone element, which is mounted next to the speaker, in the upper left hand corner of the front panel.

The optional touch tone pad was installed on the HW-2021 tested. Its performance is as good as any I have used and I especially like the action of the keys. Output of the pad is capacitivly coupled to the IC audio amplifier in the transmitter section. Waveform of the transmitted tones, as displayed on a scope is very clean.

Those of you interested in a touch tone pad for use with an existing rig would do well to consider this one. Its a very good one for the money.

Conclusions

There are a lot of components that make up the HW-2021 and they all mount on a single circuit board. Heathkit does not recommend the kit for a first time construction effort but the manual is so well written I personally feel that if you know how to solder and can follow directions you will have no trouble, regardless of your past experience. If you get nervous when wielding a soldering iron in cramped quarters, find a friend who will build it for you. Do it quickly, summer is almost here. ■

1975 CQ World-Wide DX Contest Phone Results

BY FREDERICK CAPOSSELA, K6SSS

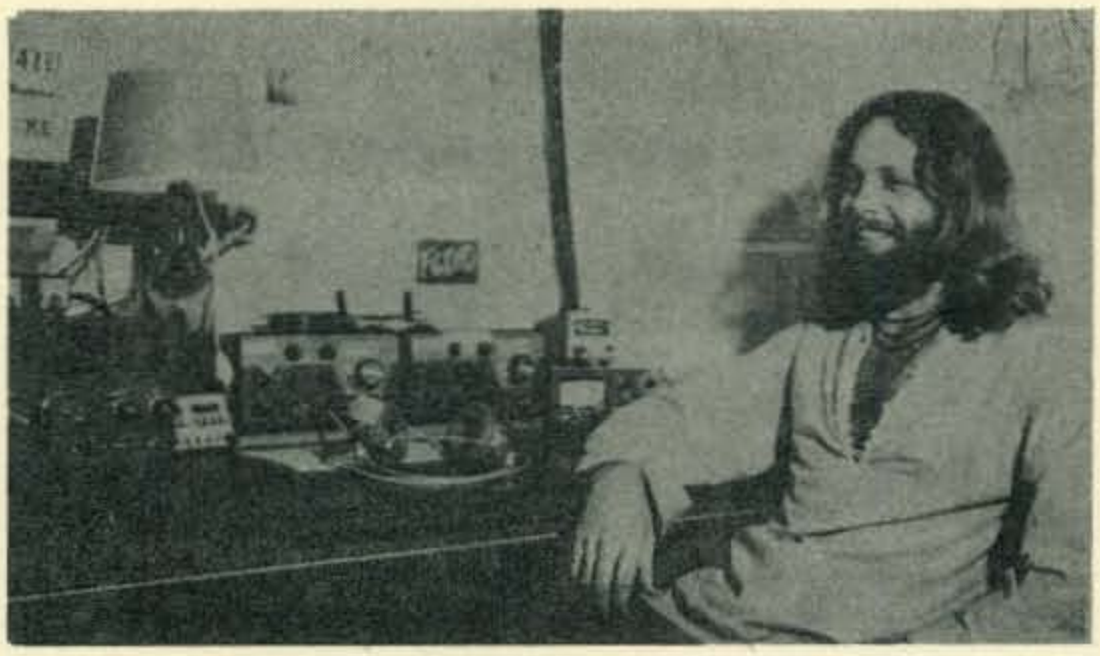
When contest stations start working over 100 countries on 10 meters, you know it's going to be an extraordinary weekend. And the October Phone Contest sure was.

By the time the dust had settled, we had a new All-Band Champion—6.6 million, FY7AK operated masterfully by F5QQ. After finishing third last year, he vowed he'd be ready this year. Congratulations, Ron!

Two Caribbean DX-peditions came in second and third—VP2G by W5MYA and KV4IJ by K6SDR. Being in N. America, they could only claim 2 points for most contacts. But even mathematically equalizing their QSO points with FY7AK, they still come out about a million behind Ron.

You won't find OA8V's 142K score in the Top Ten, but his effort sure deserves to be there. Because in a world full of 2000-watt linears, Paul did it all running only 2 w. out!

Top USA All Band honors went to 2.2 million W7RM operated by that JA-machine, K7VPF. It was those pages and pages of JA's which provided his half million margin over W1ZM manned by WA2CLQ. Right on his heels thundered competition so tightly bunched that less than 100K separated the 3rd through the 6th place finishers.



That big smile belongs to Single-op/All-Band champ, F5QQ, pilot of FY7AK. The two tri-banders and a 40m. beam Ron added this year paid off.

So many things went wrong on the VP2M DX-pedition that they started calling themselves VP2Murphy. Nevertheless, the Western Washington Gang still ran up 5.8 million to take the top Multi-Single spot. In the Multi-Multi category, a near 8-million talkathon by DLØPG outdistanced an all-local gang at PJ1AA.

Multi-Single winners VP2M, K7JCA, VE7BD, VP2MF, W7EXM, Johnny, VE7SV. They must have used more than that to run up 5.8 million.

13 Records fall

New world marks were set by XJ3BMV on 1.8 MHz. and KV4FZ on 3.5 MHz. And congratulations are also in order to new record holders W8LRL, W1EBC, W3PHL, FY7AK, CV4CR, OH2BH, OH5NW, CN8HD, EA8CR, DLØWU and VP2M.

Logging 'em As You See 'em

Reading through umpteen thousand pages of contest logs not only tells you who was working whom and when. But you also find out exactly who was thinking what during those 48 hours. No beating around the bush. Like the VK who got up to page 17 then QRT'ed for ½ hour after which he returned and made the following log entry, "hunk of steak and 3 glasses of wine." Or the European who finally worked the KH6 and after his call noted "tin ear." But the prize has to go to the WB4 who slugged his

way to page 7 when suddenly he started adding a motto on the top of each page— "Canem devoret canem, Canem devoret canem." Latin for "dog eat dog."

Your-Secret-Is-Safe-With-Me Dept.

Many thanks to the W2 who enclosed a check for $88.20 with his log. Unfortunately it wasn't made out to us, so we had to return it to him. Besides, if you want to tempt me, you've got to go to at least three figures. Equally anonymous will remain the writer of a tiny note that turned up out of nowhere saying crypticly "John: You talk a little too *loud*. Marcella wants to have a rest." It'll have to remain anonymous—the note was unsigned. The same treatment will be accorded the author of a mysterious blank postcard (no address or stamp) with only "please acknowledge receipt" written across it. We hereby acknowledge receipt.

The People Who Count

I'm extremely fortunate to have the help of a group of very dedicated individuals who serve on the Contest Committee. Quite literally, the results

When he opened his eyes, Mike, W5MYA, found he took 2nd place All-Band DX-peditioning from VP2G.

could never be done without them. They deserve a very special vote of thanks—our Chairman, Frank Anzalone, W1WY; and members Gene Walsh, K2-KUR; Bob Cox, K3EST; Bernie Welch, W8IMZ; Dave Donnelly, WB2SQN; Dick Norton, W6DGH; Larry Weaver, W6JPH; Glen Rattman, W6MAR; Jim Neiger, W6BHY; Phil Goetz, W6DQX; Larry Brockman, WA6-EPQ and Fred Laun, W9SZR. And to Kim Smith at *CQ* who made sure all logs got to California to start with. I'd also like to add my personal commendation to Daryl Kiebler, WB8EUN, and his wife, Olga, for their invaluable contributions to the committee. Our deep thanks.

That's it for now. Coming up next month, the C.W. Results. And coming up the weekend of October 30 & 31, the 1976 *CQ* WW Phone Contest.

73, Fred, K6SSS

Up and coming Multi-Single team G4DAA—G4BVH, G4-BUE, G3XBN, G3ZQW, G3MXJ, G8OS, G8KMQ, G3FXB. Operation took place from meadow on G8OS's farm.

USA QRM

"Police dropped by twice to get me to go off the air . . . *W6UFJ*. Having a 2-letter call is a big advantage—being old enough to have one is a big disadvantage . . . *K6QX*. I wish *W2HPF* would change his call, hi! . . . *WA4HPF*. *6W8FP* went off the air after we called him—someone remarked, 'maybe a lion ate him.' . . . *WA6FXM/9*. Worked *CR9AJ* 11 minutes after contest was over . . .*W6KYA*. By-pass capacitor blew up on me and XYL threw me out in rain to get potatoes for evening stew . . . *WB6OMF*. Had debate as to whether or not to claim multi-op as Murphy was my co-pilot . . . *WB6NHF*. Worked over 20 new ones . . . *WB4ZNH*. Was like a kid in a candy store chasing DX—my first contest was a fantastic experience . . . *WA3YGH*. Many contacts thanks to good ears on the other end . . . *WB2HZH*. Gave phonetics as WA3 'Single Sideband.' Reply was 'of course, I'm running Single Sideband—*QRZ*.' . . .

USA TOP SCORES

Single-Op All Band	W7RM	2,208,980	W3CRE	1,440,373
	W1ZM	1,685,125	K4VX	1,188,039
	W3LPL	1,527,750	W2HMH	1,161,043
	W6RR	1,455,772	W2GXD	1,118,725
	W7JST	1,447,016	W4QCW	983,060
	28 MHz		**7 MHz**	
	WB5HIH	13,440	W3PHL	110,799
	WA1HFN	13,052	K6QW	110,160
	K4HWW	11,515	WA6EPQ	93,438
	W8IMZ	11,450	K8LUU	44,548
	W6HX	11,312	W1FXD	43,296
	W4OZF	11,055	WB4QKE	34,470
	21 MHz		**3.5 MHz**	
	K1JHX	354,660	W1EBC	77,420
	WA6EKL	293,440	K8INX	64,974
Single Op Single Band	K4PHY	262,035	WA2LTQ	62,504
	W4FDA	214,608	W7KW	52,290
	WB9HAD	188,625	WA2EKH	39,858
	WA4OSM	182,286	WB4QNP	27,972
	14 MHz		**1.8 MHz**	
	K9PPY	314,440	W8LRL	2,871
	W9ZRX	230,298	K1PBW	2,828
	WA1NKK	221,578	WB4QZT	1,425
	WA7UWE	215,380	W2BP	760
	WB7ABK	209,280	W1BB	585
	W9IRH/7	203,320		
Multi-Op Single Xmtr	W6ONV	1,660,395	W6PAA	1,091,860
	W2HPF	1,396,747	WA1NZT	1,090,800
	K3MNT/7	1,299,455	WA1STN	1,016,760
Multi-Op Multi-Xmtr	W2PV	6,052,867	K6SEN	4,170,084
	W3AU	5,494,944	WA8ZDF	4,108,115
	WA2ZAA	5,283,540	W3WJD	4,082,784

The potent UK5MAF gang and the reasons why. Operators UB5MCD, UY5LK, UB5-059-22, UA6HZ, UB5MDC.

WA3SSB. Suggest a team of judges monitor the contest and make a published report on unsportsmanlike conduct by U.S. ops . . . *WBØFBQ.* Operators on 20 very discourteous! Other bands were great fun . . . *K4KEW/5.* Recommend special class for those stations operated by operators other than licensee. Makes it impossible for moderately-priced stations with average class of contest operators to compete for top award . . . *WB4OXD.* XYL should get award for being cooped up with 2 and 5 yr. olds during rainy weekend . . . *W1MDO.* It sure is easier from the East Coast on 80. Would have lost 2 nights sleep to approach this year's results from the West Coast . . . *W1SD (ex-W6DQ).* First time I've worked Africa on 10 and I did it twice . . . *WB2TLD.* We all could score more points if some stateside ops used their receiver as much as their amplifier . . . *WB2LOF.* Hope next year that credit for Canadians is not given except for country and zone credit—at very least make them count one point . . . *WA2LTQ.* Having a good friend go on PJ8YFQ DXpedition and then working him for last QSO of the contest . . . *WA4HEK.* Would have been on longer, but had to watch the Goodyear Blimp land at our airport . . . *WB9BSH.* First contact on 40 was with *6W8FP*—it sounded like 20 . . . *WB9AJZ.* Working *OJØMA* was a real thrill . . . *K9HKF.* One bit of advice—never try to sell your car the same weekend of a DX contest!!! . . . *WA9JDT.* I know I didn't win, but it was the most fun I've had in years as a ham . . . *WB9IJV.* The use of tape recorders and programmed c.w. senders should not be allowed as this is not a part of operator skill. Maybe there should be a new class called 'Professional amateur radio stations.' . . . *K8INX.* Missed prime times, raking, mowing and fertilizing my yard . . .*W8KOD.* It was fun to a point . . . *W5OSH.* Wait 'til next year . . . *WØEEE.* Thrill to have *EA8CR* show up on 160 unannounced . . . *W2BP.* Murphy never left the shack . . . *WA3VQP.* Due to Penn State-Army game could only work Sunday . . . *WA3UXP.* It's been a long time since I've heard condx on 15 so good . . . *WA5RTG.* Having a General class license is a tremendous disadvantage in a DX contest—especially on 40 and 80 . . . *WB2SJG.* First year I didn't get called all weekend even tho I was on surgery call . . . *K5JZN/3.* Why do stateside stations think 10 is only open during contests? . . . *K3IGA/4.* Surprised when *9J2GJ* and ZD8RW answered my CQ on 10 . . . *WA4JQS.* Missed Rhodes due to city-wide power failure . . . *WAØHFW/4.* QRM extremely bad from XYL . . . *K4SGL.* QRN on 160 was 59 plus 10 until *W8LRL* told me what a beverage antenna was. Put up a 700 foot one in middle of night and QRN reduced to nothing—thanks to *W8LRL* . . . *WB4QZT.* Neighbor's burglar alarm going off and a funeral didn't help matters . . .*W5OSJ.* Utilized all 3 drivers during European opening on 15 as Murphy kept striking

DX QRM

"The South Americans and Africans on 80 were about as rare as a *W3AU* QSL card . . . *G3HTA.* Biggest thrill: in the middle of the second night with propagation completely closed, *9N1MM* gave me a call with S9 plus . . . *3A2GX.* Score would have been 5.5 million if in 3-point area only 85 miles away—frustrating . . . *W5MYA* opr. of *VP2G.* Largest log ever!—2 QSOs . . . *VP8NX.* Without doubt, this contest is one of the most important events for every radio amateur . . . *LU4MBI.* Hard work . . . *ZL1BKX.* Thank you, Henry & Bea . . . *WA7UQV* opr. of *XJ7WJ.* Not a good year for me—had to work on the 25th and lost beam on the 26th . . . *VP9AD.* I'm surprised to hear so many W6 stations using 3.8 MHz. beam antennas! . . . *JA4BKL.* Sure missed my *HS2AIG* call of last year . . . *KA6DX.* Glad to get 10 new countries . . . *JAØTKU.* No band condx for nearly 15 hours; no beer; no bread; otherwise another good contest, hi . . . *CR6IK.* Conditions were *too* good on 10, we weren't prepared for it . . . *DK2BI. VE2AQS/TG9* is a mouthful especially when you have been yelling for 48 hours . . . *VE2AQS/TG9.* Hope to be on 160 and have a beam on 40 to work stations heard . . . *9Y4NP. Greatest handicap was my call sign . . . WB9AJF/6Y5.* Being a new country, we wanted to hand-out maximum contacts, not search out multipliers and our score

WORLD TOP SCORES

Single-Op All Band	FY7AK	6,636,348	W7RM	2,208,980
	VP2G	4,245,813	UB5WE	2,016,483
	KV4IJ	3,247,986	W1ZM	1,685,125
	6W8FP	2,596,186	OK2RZ	1,531,868
	G3LNS	2,595,692	W3LPL	1,527,750
	28 MHz		**7 MHz**	
	CV4CR	668,624	OH5NW	167,751
	CR6FW	279,680	YZ1BCD	149,600
	CX8BE	271,353	W3PHL	110,799
	LU8FEU	166,452	K6QW	110,160
	PY3BXW	125,624	WA6EPQ	93,438
	CE4EM	60,780	I5FCK	92,904
	21 MHz		**3.5 MHz**	
Single-Op Single Band	G3WJN	533,943	KV4FZ	275,319
	CX3BH	505,788	XJ3EDC	141,726
	VK6CT	468,309	CN8HD	140,651
	EA8JJ	455,975	I3MAU	113,535
	YV4YC	436,08	W1EBC	77,420
	YZØSRJ	422,816	OH1XX	71,640
	14 MHz		**1.8 MHz**	
	CW3BR	1,104,872	XJ3BMV	8,640
	OH2BH	981,815	PAØHIP	3,024
	CR6IK	842,394	W8LRL	2,871
	G3XYP	810,434	K1PBW	2,828
	I1GPK	710,646	VE3ECP	2,754
	G3HCT	704,459	WB4QZT	1,425
Multi Op Single Xmtr	VP2M	5,792,750	DLØWU	4,208,312
	EA8CR	4,673,005	VP5WW	3,532,797
	UK9AAN	4,328,390	FGØMM	3,035,840
Multi-Op Multi-Xmtr	DLØPG	7,930,918	W2PV	6,052,867
	PJ1AA	6,989,316	W3AU	5,494,944
	DK2BI	6,059,119	WA2ZAA	5,283,540

HV3SJ went Multi-Single in a big way. That's JA4CBP, DF2GX and DJ3HJ who joined Brother Ed.

BAND-BY-BAND BREAKDOWN—TOP ALL BAND SCORES

Number groups indicate: QSO's/Zones/Countries on each band.

WORLD TOP SINGLE OPERATOR – ALL BAND

Station	160	80	40	20	15	10
FY7AK	11/5/5	320/17/44	438/22/66	1165/33/112	1999/27/89	634/22/56
VP2G		348/14/39	535/19/53	970/28/92	1629/27/90	868/19/48
KV4IJ	8/3/6	518/11/42	480/15/39	856/25/76	1350/22/64	905/16/38
6W8FP		12/8/8	220/16/25	720/32/85	959/29/90	350/22/74
G3LNS	3/1/3	166/11/34	214/17/60	1172/25/66	1098/28/75	23/8/18
W7RM	15/6/6	139/22/40	417/23/50	484/28/73	1019/27/72	21/9/9
UB5WE		268/10/40	169/16/47	1061/33/102	637/23/73	89/12/37
W1ZM		225/22/68	76/16/40	533/29/84	493/27/97	63/11/31
OK2RZ		279/8/34	156/13/35	729/26/87	625/31/87	30/11/24
W3LPL	10/4/5	117/20/63	106/20/60	426/29/84	495/25/99	52/11/30

USA TOP SINGLE OPERATOR – ALL BAND

Station	160	80	40	20	15	10
W7RM	15/6/6	139/22/40	417/23/50	484/28/73	1019/27/72	21/9/9
W1ZM		225/22/68	76/16/40	533/29/84	493/27/97	63/11/31
W3LPL	10/4/5	117/20/63	106/20/60	426/29/84	495/25/99	52/11/30
W6RR		49/13/23	160/20/48	310/27/76	849/26/75	73/14/31
W7JST	1/1/1	52/18/32	295/26/50	355/33/83	570/30/69	46/13/26
W3CRE	3/2/2	100/15/46	86/18/53	831/33/107	177/22/73	44/10/26
K4VX	10/3/6	94/14/43	63/17/39	265/24/71	597/27/100	77/13/36
W2HMH		111/13/48	107/17/56	392/27/76	365/27/83	78/15/40
W2GXD		77/12/37	71/17/43	323/25/73	547/22/87	63/14/35
W4QCW	8/3/6	117/18/56	112/19/56	275/25/69	326/24/77	49/13/32

WORLD TOP MULTI-OPERATOR – SINGLE TRANSMITTER

VP2M	39/5/13	564/18/52	713/22/61	1267/32/104	1983/27/97	779/18/44
EA8CR	12/3/5	486/19/70	389/19/59	785/30/96	1115/27/89	240/22/84
UK9AAN		340/18/63	556/30/84	1031/35/126	527/28/92	320/18/51
DLØWU	11/2/11	191/14/45	576/19/72	1144/32/104	1230/31/101	85/13/34
VP5WW	13/3/5	730/12/45	453/14/46	1627/22/66	1678/20/58	91/15/27
FGØMM	2/1/2	546/10/29	444/17/44	1243/28/88	1484/19/48	686/12/22

USA TOP MULTI-OPERATOR – SINGLE TRANSMITTER

W6ONV		57/18/30	444/25/44	285/27/79	838/27/77	20/8/12
W2HPF	7/2/4	150/19/67	82/21/58	461/27/83	366/24/101	43/11/34
K3MNT/7	5/3/3	73/15/26	403/20/35	406/30/78	645/23/50	12/4/6
W6PAA	4/4/4	96/16/28	276/22/43	380/25/62	462/22/56	30/11/15
WA1NZT		134/17/53	84/16/51	313/27/81	390/23/83	62/13/36
WA1STN	6/3/4	94/12/47	71/17/42	445/28/72	307/23/83	56/10/29

WORLD TOP MULTI-OPERATOR – MULTI-TRANSMITTER

DLØPG	105/3/14	787/21/72	975/24/84	2600/36/135	929/33/132	139/17/46
PJ1AA	14/5/9	481/15/54	401/18/51	1698/32/113	1532/25/87	929/21/48
DK2BI	94/2/11	454/12/54	603/26/81	1700/35/116	1588/34/122	89/14/40
W2PV	60/11/18	654/23/83	360/28/92	1461/36/130	949/32/120	94/13/43
W3AU	35/6/12	280/22/74	302/27/86	1055/37/134	1206/32/128	177/16/55
WA2ZAA	32/7/12	455/22/81	247/23/75	1547/35/133	801/32/123	111/11/42

USA TOP MULTI-OPERATOR – MULTI-TRANSMITTER

W2PV	60/11/18	654/23/83	360/28/92	1461/36/130	949/32/120	94/13/43
W3AU	35/6/12	280/22/74	302/27/86	1055/37/134	1206/32/128	177/16/55
WA2ZAA	32/7/12	445/22/81	247/23/75	1547/35/133	801/32/123	111/11/42
K6SEN	36/7/8	261/24/62	438/29/72	831/36/110	1157/31/87	132/16/39
WA8ZDF	51/6/11	378/22/69	405/28/85	1080/36/116	651/28/111	124/13/40
W3WJD	23/5/8	439/23/80	239/27/82	844/34/110	920/27/112	116/14/46

shows this . . . *VX9A*. Please find enclosed 4 entries from Greater Peterborough ARC. We hope our acorn will grow to a 54 Megapoint oak in a few years! . . . *G4BBA*. USA cross-band on 3.8 MHz, that was a surprise and 59+ most of them, second shock was *VP5WW* on a CQ . . . *VK3AAO*. Number of improvements paid off this year—shorter callsign; speech processing; beam on 40; 2-hour nap before contest; and hunting multipliers a lot; but major improvement was the YL who kept me company, fed me and kept me going until the end . . . *F5QQ* opr. of *FY7AK*. Worked *9V1SH* more than 12,000 miles away—5,000 miles per watt . . . *OA8V*. SRI to send in such a poor log—but I tried! My own rig failed a week before—not fixed yet. Elec. failed Sat. P.M.; poured (rain) entire weekend; Sat. & Sun. work days in my profession (priest). Finally borrowed rig with bad ant. with 2 hrs. to go; couldn't crack QRM; finally got started & had to QRT for work . . . *CEØAE*. "Europeans don't copy me—believe that they don't have good receivers. Hi . . . *4M4GD*. This is my first contest . . . *YV5YL*. Poor conditions. (Band) only open 11 hours the first day, and 10 hours the second day. In the South Pacific I could only work *5W1AU* . . . *CV4CR*. *5J4* was a special prefix used during two weeks by the stations of Medellin, Colombia in commemoration of 300 years foundation of the city. My congratulations for the finest contest in the world. After ten years of not being active in ham radio, I came back and found the contest more interesting than ever . . . *5J4EB*. The antenna stuck east and two local amateurs had to climb up the 65 foot tower . . . *EA8JJ*. Very difficult to work W stations on 20 m. with my vertical antenna . . .*TU2DF*.

Single Band Million-pointer, CW3BR, had a field day on 20.

No opening from Morocco to South America on 3.5 . . . *CN8HD*. Nothing *at all* heard on 40 & 80 . . . *VQ9D*. Had good fun. Not enough activity on 21 MHz . . . *ZS6YK*. Very hard to break through the JA wall to the states, otherwise great. Fancy having *BV2B* as a duplicate . . . *VS6AF*. Noticed a bit too late, at the fag end of the contest, that only the rotator was moving & not the Telrex—the lock pin had snapped! . . . *VU2DK*. Beautiful conditions and good European discipline for change, hi . . . *EP2SN*. Biggest thrill was being called in pileup by stations like *3B9DA* and *HV3SJ* . . . *EP2OD*. Picked up 6 new countries for DXCC. Think more should try 28 MHz more often as the band was open most of the daylight hours in the Middle East . . . . *EP2EJ*. Unbelievable opening to W6, W7 on 20 meters Saturday night, but since operating single band 21 it didn't matter . . . *WA2KGY/4X*. U.S. Operators very good on 80 & 40 this direction—*very* strong signals this way from W6's. Did

(Continued on page 69)

TROPHY WINNERS

Single-Operator Single Band

Martin Laine, OH2BH (14 MHz)
World Phone Trophy
K7HLB Memorial Trophy (NJDXA)

R.T. Nash VE3KZ (21 MHz)
Canadian Phone Trophy
Donor: Gene Krehbiel, VE6UP

Herbert Schoenbohm KV4FZ (3.5 MHz)
Carib./C.A. Phone Trophy
Donor: G. Keutner, HR1GK

Mario Pablo Rebufello CV4CR (28 MHz)
So. American Phone Trophy
Donors: Brazil DXers

Single-Operator All Band

FY7AK (Opr. Ron Delcourt, F5QQ
World Phone Trophy
Donor: Bill Leonard, W7SKT

W7RM (Opr. Chip Margelli, K7VPF)
USA Phone Trophy
Donor: Potomac Valley Radio Club

XJ3HUM (Opr. D.W. Dudley, VE3BVD)
Canadian Phone Trophy
Donor: Jack Baldwin, VE7BS

G. Beasley, G3LNS
European Phone Trophy
Donor: W1BVV Operators

James R. Perry, TI2WX
Carib./C.A. Phone Trophy
Donor: Harold Fox, W1AA

Rutilio Ferreira Graca, C9MIZ
African Phone Trophy
Donor: Gordon Marshall, W6NH

Norm Styer, EP2SN
Asian Phone Trophy
Donor: Japan CQ Magazine

Katashi Nose, KH6IJ
Oceania Phone Trophy
Donor: Northern California DX Club

Multi-Operator Single Transmitter

VP2M (VE7SV, K7JCA, VE7BD, W7EXM VP2MF)
World Phone Trophy
Donor: John Knight, W6YY

Multi-Operator Multi-Transmitter

DLØPG (DK2OL, DK3BJ, DJ9IE, DJ5KY, DJ9TO, DK1OV, DK1FW, DJ1FC, DK7QC
World Phone Trophy
Donor: Radio Club Weinheim

Expedition Trophy

VP2M (VE7SV, K7JCA, VE7BD W7EXM, VP2MF)
Donor: Stuart Meyer, W1GHK

Special CQ Plaque

Rafael Ponce de Leon, CW3BR
Zal Kabraji, VU2DK

Number groups after call letters denotes following: Band, (A-all) Final Score, Number of QSTs, Zones and Countries. Certificate winners are listed Bold Face.

PHONE RESULTS SINGLE OPERATOR NORTH AMERICA

United States

W1ZM	**A**	**1,685,125**	**1390**	**105**	**320**
(Opr. WA2CLQ)					
W5UDK/1	A	624,102	645	84	270
WA1RHA	A	529,878	673	72	210
W1DAL	A	340,752	550	59	170
WA1SKV	A	286,220	458	57	163
WA1NRF	A	207,438	340	62	169
W1BIH	A	149,504	223	68	188
W1HWM	A	110,188	249	48	115
WA1SQB	A	80,730	225	34	96
W1JFL	A	76,486	170	54	113
W1WY	A	71,868	184	54	105
W1JDE	A	52,932	160	38	94
W1GPK	A	38,744	130	37	79
WA1SCX	A	6,480	48	17	31
W1PLJ	A	6,264	60	10	26
K1AGB	A	4,750	36	16	34
WA1HAA	A	4,067	33	17	32
WA1HFN	**28**	**13,052**	**97**	**12**	**40**
WA1UAD	"	10,339	90	11	38
K1JHX	**21**	**354,660**	**875**	**26**	**112**
W1MDO	"	120,536	346	24	78
W1HDI	"	24,948	108	22	62
WA1UVB	"	17,472	101	17	47
K1IIK	"	11,712	70	17	44
WA1UZH	"	2,288	33	7	19
WA1NKK	**14**	**221,578**	**630**	**29**	**90**
WA1RGW	"	44,416	237	14	50
W1HDN	"	41,965	190	19	58
W1FXD	**7**	**43,296**	**178**	**24**	**72**
W1YN	"	27,048	121	20	64
W1EBC	**3.8**	**77,420**	**330**	**22**	**76**
WA1JMP	"	17,226	139	11	43
WA1FBX	"	6,952	65	12	32
W1SD	"	6,532	56	12	34
K1PBW	**1.8**	**2,828**	**48**	**9**	**19**
W1BB	"	585	16	6	7

W2HMH	**A**	**1,161,043**	**1040**	**99**	**304**
W2GXD	**A**	**1,118,725**	**1081**	**90**	**275**
W2RHE	A	489,985	650	65	200
W2HNO	A	425,986	551	75	214
W2HBT	A	397,898	504	67	216
WB2CKS	A	353,073	428	81	220
W2RFL	A	346,104	537	65	163
K9EGA/2	A	344,760	509	69	186
W2EHB	A	272,076	391	65	181
WB2JJN	A	202,560	327	62	178
W2HHB	A	152,298	313	52	127
W2AX	A	148,782	292	47	134
W2LEJ	A	138,284	275	52	129
WB2SJG	A	113,386	241	50	128
K2BK	A	109,178	258	48	110
W2LYL	A	102,660	253	40	105
WB2HZH	A	92,002	226	51	106
WA2DLV	A	79,946	210	36	106
WB2RKK	A	77,312	215	38	90
K2JOC	A	76,035	225	31	80
WA2LJM	A	73,780	196	41	99
WA2ZWH	A	69,978	226	31	78
K2SNK	A	66,674	218	31	75
WB2NDR	A	57,400	165	42	98
WB2VFT	A	54,912	152	41	102
WB2QCF	A	52,628	166	37	81
W2FGY	A	43,641	141	31	86
W2PFQ	A	42,356	139	31	85
WA2EAH	A	38,313	110	42	87
W2ZHN	A	29,539	107	31	78
W2MB	A	27,100	106	29	71
WB2HJW	A	17,050	98	18	44
WA2UYL	A	4,869	30	16	23
WA2EJZ	A	4,089	35	18	29
W2FXN	A	1,029	19	9	12
WB2TLD	**28**	**5,400**	**56**	**11**	**29**
WA2AUB	"	3,744	41	11	28
W2NIN	**21**	**180,880**	**473**	**25**	**108**
WB2PWU	"	90,871	261	27	94
WB2ZGI	"	59,590	209	22	79
WB2TKY	"	48,500	173	26	74
WB2LOF	"	31,680	142	21	59
WB2WRR	"	4,625	49	11	26
W2FDE	"	2,958	33	10	24
W2FVS	"	1,628	30	7	15
WB2IWH	"	864	19	4	14
W2DT	**14**	**44,737**	**200**	**18**	**59**
K2QBV	"	34,710	191	20	45
W2JGR	"	17,202	123	14	33
K2DTQ	7	646	22	6	11
WA2LTQ	**3.8**	**62,504**	**254**	**25**	**79**
WA2EKH	"	39,858	234	16	57
WA2LCC	"	2,968	51	8	20
WA2EAH/M2	"	220	11	4	7
W2BP	**1.8**	**760**	**16**	**6**	**13**

W3LPL	**A**	**1,527,750**	**1206**	**109**	**341**
(Opr. WA3HRV)					
W3CRE	**A**	**1,440,373**	**1241**	**100**	**307**
W3VT	A	646,170	650	92	270
W3GRF	A	555,788	700	75	209
K3EF	A	352,500	459	79	203
W3USS	A	319,176	464	69	195
K3ZAW	A	314,084	455	55	178
K3ZOL	A	210,897	346	61	158
WA3WRD	A	209,898	371	57	150
W3KT	A	207,460	333	61	169
K3AWZ	A	196,650	322	64	166
W3GRS	A	196,075	295	69	184
W3KFQ	A	154,682	307	49	129
W3KV	A	153,153	301	53	134
WA3YGH	A	143,234	297	54	128
W3GID	A	136,422	248	57	141
WA3NNA	A	124,450	242	58	132
W3MFJ	A	119,886	374	43	116
W3JSX	A	115,392	235	58	134
W3GL	A	114,270	233	60	135
WA3SZI	A	96,850	278	31	99
WA3SSB	A	91,377	206	38	105
K3BNS	A	87,216	219	38	100
K3WOK	A	86,724	220	42	104
W3ZNH	A	79,566	168	55	123
W3JPT	A	78,150	201	42	108
W3YHR	A	54,511	139	43	108
W3GZQ	A	49,320	160	39	81
W3CGS	A	47,082	142	39	79
W3EVW	A	42,572	132	39	77
W3HVM	A	39,936	142	27	77
WA3WNU	A	32,342	120	32	71
W3ML	A	28,200	108	30	70
W3BB	A	27,548	135	19	52
W3YFV	A	24,395	106	27	58
W3ZJ	A	19,926	97	26	55
W3AEL	A	3,405	61	11	27
W3GCQ/3	A	616	18	6	8
W3ZSR	A	513	10	9	10
WA3HMM	**28**	**9,894**	**194**	**13**	**38**
K3AIG	**21**	**65,835**	**218**	**25**	**80**
W3EWL	"	59,090	219	20	75
WA3RRS	"	57,268	198	22	81
W3ZPO	"	33,803	156	19	58
WA3OPX	**14**	**190,653**	**628**	**25**	**78**
WA3VQP	**"**	**182,800**	**624**	**25**	**75**
W3DBT	"	118,335	355	31	84
WA3UXP	"	2,295	30	7	20
W3PHL	**7**	**110,799**	**337**	**29**	**88**
K5JZN/3	"	14,732	104	15	43
W3KMV	**3.8**	**10,123**	**83**	**13**	**40**

K4VX	**A**	**1,188,039**	**1106**	**98**	**295**
W4QCW	**A**	**983,060**	**887**	**102**	**296**
(Opr. WA8ZDT)					
W4UPJ	**A**	**815,915**	**875**	**83**	**248**
K4PQL	A	600,357	748	67	226
W4UGE	A	560,320	643	82	238
W4MYA	A	555,772	640	86	236
K4EKJ	A	469,660	710	59	171
WA4HPF	A	430,014	556	82	216
WB4OSS	A	401,250	471	85	236
K4KZZ	A	396,342	508	75	216
W4ZSH	A	354,716	441	73	211
WB4OSN	A	354,060	485	76	205
WA4EYR	A	341,288	415	84	212
W4ORT	A	320,144	445	73	199
W4WRY	A	316,799	440	71	200
K4JWD	A	314,662	442	70	192
W4PRO	A	289,200	441	60	180
K4EZ	A	248,235	378	73	174
WB4BVY	A	237,669	381	61	166
WB4UYD	A	227,470	378	57	158
WB4OXD	A	205,110	288	104	161
W4ZTW	A	198,720	351	58	158
K4ZRX	A	191,864	303	62	170
W4KNW	A	187,368	305	61	161
K4AUL	A	174,070	311	53	153
WA4GQJ	A	173,582	275	69	160
K4CL	A	172,380	314	58	146
WB4ZNH	A	170,495	309	64	151
WB4BAU/4	A	152,914	288	55	147
WA4UFW	A	152,453	284	61	142
W4UYC	A	134,008	279	43	121
LU8AGT/WA	A	128,710	238	68	143
WB4KTR	A	115,624	236	55	139
WA4UAZ	A	113,740	229	54	134
WB4TBO	A	106,248	257	42	110
W4HJ	A	101,536	218	59	108
WB4FOT	A	74,250	187	38	97
W4IQ	A	70,704	186	40	104
W4KFC	A	67,800	206	31	89
K4ND	A	65,258	173	43	91
K4NJM	A	62,823	181	35	94
W4LVM	A	55,062	166	41	92
WA4EWX	A	52,959	159	35	92
W4NQA	A	48,732	145	37	87
K4UEE	A	48,026	149	42	76
W4WEG	A	45,024	141	33	79
K4GFH	A	41,300	150	25	75
WA0MYM/4	A	33,078	101	33	78
K4TBN	A	30,555	108	29	76
W4KMS	A	22,632	86	31	61
K4JYM	A	19,422	94	23	55
WB4ILR	A	16,280	81	18	56
K4PHE	A	15,410	71	20	47
WA4DRU	A	13,020	58	31	53
W4ZM	A	12,608	74	18	46
W4UVP	A	10,703	64	24	53
W4HVU	A	9,300	51	22	40
WA4GAB	A	7,743	107	26	47
WB4WHE/4	A	6,328	52	21	35
K4ZA	A	4,592	43	14	27
WA4CWU	A	4,508	41	17	29
W4HOS	A	2,440	42	21	35
W4GF	A	1,782	25	9	18
K4KA	A	1,696	23	10	22
W4UW	A	1,137	43	10	27
W4IZ	A	775	16	10	15
K4HWW	**28**	**11,515**	**90**	**14**	**33**
W4OZF	**"**	**11,055**	**78**	**15**	**40**
K3IGA/4	"	10,506	83	15	36
WA4JQS	"	5,355	76	11	24
K4TWJ	"	3,663	44	10	23
K4PHY	**21**	**262,035**	**674**	**29**	**106**
W4FDA	**"**	**214,608**	**546**	**29**	**107**
WA4OSM	"	182,286	511	27	96
W4WSF	"	154,759	438	23	98
K4ISV	"	151,927	390	31	108
K4DJC	"	141,771	395	27	102
WB4IUX	"	118,625	330	25	100
W8FAW/4	"	87,108	252	28	95
WA0HFW/4	"	63,444	220	24	78
K4SGL	"	60,162	193	25	86
WA4HEK	"	22,100	130	19	46
WB4TEL	"	11,343	72	16	41
WA4NFF	"	10,100	73	13	37
WB4SIJ	**14**	**105,408**	**307**	**28**	**94**
WB4YPT	"	63,296	242	21	71
WA4FMS	"	28,842	151	16	50
WB8IIN/4	"	19,244	108	18	50
W4EEO	"	2,074	22	13	21
WB4QKE	**7.0**	**34,470**	**136**	**23**	**67**
WR4KSE	7.0	20,935	98	21	58
W4DJD	7.0	17,219	101	18	49
W4BV	7.0	12,122	81	14	44
WB4QNP	**3.8**	**27,972**	**136**	**19**	**65**
W4BAA	"	17,010	109	17	46
W4RX	"	9,724	82	16	36
K4KZP	"	5,625	54	12	33
WB4QZT	**1.8**	**1,425**	**56**	**10**	**15**

K5PFL	**A**	**616,400**	**704**	**96**	**239**
WA5RTG	**A**	**581,828**	**640**	**93**	**241**
K5FVA	A	550,500	573	97	278
W5NMA	A	484,484	589	88	220
K5KLA	A	244,464	351	76	188
K5VTA	A	238,280	356	74	185
W5KKZ	A	218,550	366	66	169
K5EWJ	A	199,440	328	73	167
W5KHP	A	190,209	334	63	150
W5JWM	A	162,720	271	72	154
W5UCE	A	134,848	265	58	138
WA5WMC	A	128,154	247	56	130
K4KEW/5	A	108,942	201	66	135
WB5IFY	A	101,325	216	51	124
W5HIC	A	60,207	166	45	96
W5KTA	A	53,958	146	46	92
W5OB	A	49,764	143	46	97
WA5WEY	A	48,910	142	45	89
WA5EZQ	A	28,672	107	38	74
W5ORX	A	25,410	93	42	68
W5OSH	A	16,716	74	29	55
W5UTT	A	16,650	88	26	49
WB5MXS	A	14,195	67	35	50
WA5VOQ	A	12,600	76	34	50
W5RTX	A	10,521	64	20	43
W5NVU	A	10,150	64	20	38
WA5TRX	A	9,387	63	23	40
WA5NDV	A	9,135	55	25	38
W5FXQ	A	8,607	56	22	35
WB5CJE	A	6,136	47	15	37
K5LZJ	A	5,824	47	20	32
W5AE	A	3,595	52	20	33
W5ONL	A	3,008	39	8	24
WB5OOW	A	2,040	25	13	21
WA5IEV	A	1,100	16	10	15
W5EDX	A	252	9	9	9
WB5HIH	**28**	**13,440**	**127**	**15**	**41**
WA5VDH	"	8,560	86	11	29
WA5SDT	**21**	**143,637**	**393**	**27**	**100**
W5UOJ	21	88,400	317	25	75
W5OSJ	21	57,000	218	26	69
W5GO	"	41,454	157	24	70
W5WZQ	"	1,150	19	8	15
W5WO	"	525	13	5	10
WB5UHT	"	130	6	4	6
W5TWI	**14**	**112.125**	**366**	**25**	**90**
W5LEL	"	2,706	34	9	24
K5FJP	**3.8**	**15,939**	**109**	**17**	**46**
K5DEG	"	6,069	52	15	36

W6RR	**A**	**1,455,772**	**1441**	**100**	**253**
VE3DXV/W6	**A**	**703,750**	**985**	**89**	**161**
W6PLH	A	607,355	1,111	65	120
K6UJS	A	499,239	785	80	141
W6RDF	A	421,616	725	71	137
(Opr. WA6CXK)					
W6KNC	A	387,982	651	76	138
W6MAR	A	358,914	533	85	161
W6EYY	A	306,681	718	59	92
WB6NHF	A	264,708	542	61	111
W6JOT	A	206,241	409	66	117
K6ITL	A	197,448	455	53	99
W6OKK	A	190,232	393	59	113
W6ANB	A	174,552	354	61	107
WA6GFY	A	153,408	410	51	85
(Opr. WB6EXW)					
W6RNU	A	129,168	370	49	89
W6UFJ	A	118,069	252	62	105
W6YVK	A	107,250	252	58	92
K6ELX	A	93,960	366	29	58
W6LQC	A	90,259	250	44	87
K6YYQ	A	89,300	310	45	55
K6QX	A	80,919	345	29	52
WA6NBY	A	78,592	226	52	76
W6BJB	A	74,148	233	41	70
WB6OMF	A	73,793	236	31	78
W6ABT	A	72,289	168	61	100
W6BZE	A	59,118	180	52	56
W6HXW	A	56,265	168	42	79
W6ZUM	A	52,704	170	48	74
WB6ZHD	A	46,494	137	53	73
K6PO	A	34,560	153	33	47
W6KYA	A	30,876	118	38	55
K6OC	A	27,520	110	33	53
WA6LBP	A	20,944	88	38	50
WA6TKT	A	19,175	100	30	35
W6NJU	A	18,530	86	32	53
W6VPZ	A	18,054	68	23	79
(Opr. W6CFM)					
W6PRP	A	17,658	81	32	49
W6DGH	A	16,434	87	37	46
WA6UOU	A	15,808	100	28	36
K6PI	A	15,225	73	32	43
W6HNX	A	11,748	76	30	36
K6MA	A	4,070	34	27	28
W6ORD	A	3,432	36	19	25
W6SC	A	3,198	29	17	22
W6JPH	A	1,976	23	17	21
W6RQZ	A	1,066	19	11	15
WA6UFY	A	931	19	9	10
W6HX	**28**	**11,312**	**85**	**15**	**33**
W6PXG	"	10,845	102	14	31
WA6EKL	**21**	**293,440**	**892**	**27**	**85**
WB6PNB	"	102,500	355	25	75
WA6DNM	"	20,657	82	30	61
K6UF	**14**	**188,500**	**584**	**35**	**81**
W6OK	"	32,004	187	19	44
W6EUF	"	31,809	160	24	45
W6FF	"	17,064	89	24	48
WA6WUI	"	11,180	107	20	23
W6ID	"	4,680	40	16	29
W6TPR	"	4,104	37	16	22
K6QW	**7**	**110,160**	**438**	**27**	**58**
WA6EPQ	"	93,438	379	25	62
W6ITY	**3.8**	**19,008**	**128**	**20**	**44**
WA6PDE/M6	"	4,290	55	14	19
K6SVL	"	1,144	20	11	15

W7RM	**A**	**2,208,980**	**2095**	**115**	**250**
(Opr. K7VPF)					
W7JST	**A**	**1,447,016**	**1319**	**121**	**261**
K7RSC	A	831,111	1224	80	153
W7TML	A	516,224	827	75	143
WA0GQI/7	A	485,780	750	76	151
WA7PMI	A	480,636	715	77	157
WA7OBL	A	392,640	855	53	107
WA7NFH	A	358,800	580	75	155
W7YTN	A	347,657	562	75	148
W7YBX	A	275,232	538	68	115
WA7ZLC	A	224,256	657	51	77
WA7JCB	A	222,580	617	44	80
W7NP	A	135,168	378	45	83
W7LZF	A	109,494	307	46	80
WA7IVZ	A	92,261	228	59	92
WB4JBS/7	A	75,900	357	26	49
K7YDO	A	48,200	219	38	62
W7UBA	A	46,325	193	28	57
W7OTO	A	38,423	181	29	48
W7BCT	A	33,098	169	24	43
W7MCU	A	31,302	105	43	68
W7OF	A	24,376	105	32	56
WA7OBH	A	24,206	110	34	57
W7MB	A	20,736	116	36	64
WA7NUH	A	15,686	92	25	37
LU6DAZ/W7	A	12,915	74	26	37
K7MOK	A	12,670	82	31	39
W7JUO	A	11,444	65	26	40
K7CVL	A	10,633	75	18	31
W7RIR	A	8,968	66	28	31
W7GUR	A	8,250	51	20	35
W7BOG	A	6,360	57	16	24
WA7GVA	A	5,664	45	22	26
W7HAD	A	3,416	39	15	13
W7GVF	A	2,700	38	13	14
WDX7UZU(SWL)		7,670	44	24	41
W7AYY	**28**	**4,123**	**51**	**10**	**21**
K7IDX	"	4,060	66	12	17
WA7WMG	21	2,884	38	10	18
WB7ALT	21	630	20	7	7
WA7UWE	**14**	**215,380**	**703**	**28**	**82**
WB7ABK	"	209,280	562	32	96
W9IRH/7	"	203,320	605	31	84
WA7EOL	"	119,944	468	27	61
W7AWH	"	94,860	386	24	69
WA7PEZ	"	43,216	201	22	52
W7GYP	"	33,033	146	23	54
W7SCO	"	8,330	60	17	32
WA7GOO	"	7,704	76	16	20
K7RSB	"	2,678	38	10	16
W7KW	**3.8**	**52,290**	**221**	**24**	**66**
WA7OFH	"	3,666	45	16	23
W7JLU	"	3,400	66	12	13

W8TWA	**A**	**449,755**	**533**	**83**	**224**
WA8UUY/8	A	263,898	408	68	175
K8YRV	A	262,025	407	64	171
WA8AWH	A	174,828	326	55	149
W8BDO	A	169,034	309	55	168
WB8IOT	A	133,200	277	50	135
K8TMK	A	77,778	194	38	111
K8NGR	A	74,778	166	39	121
WB8EEJ	A	45,804	137	40	92
W8FJS	A	30,096	114	37	77
W3GN/8	A	11,026	67	30	44
W8IMZ	28	11,450	101	12	38
WA8KCX	**21**	**144,144**	**417**	**24**	**93**
WA8OXG	"	135,135	367	27	108
WB8GKG	"	100,838	291	27	100
W8KOD	"	54,600	196	23	77
K8RWL	"	52,380	175	24	84
WA8VZO	"	17,202	103	15	46
WB8LZX	14	7,137	64	12	27
K8LUU	**7**	**44,548**	**214**	**22**	**64**
WA8LXJ	"	4,242	39	14	28
K8INX	**3.8**	**64,974**	**331**	**21**	**70**
W8LRL	**1.8**	**2,871**	**89**	**11**	**18**

WB9BPG	**A**	**838,272**	**846**	**91**	**263**
WA9BWY	A	574,922	642	92	245
W9NQW	A	453,730	581	73	216
WA9NPM	A	363,792	499	72	192
K9KGA	A	339,600	526	65	175
WB9CEP	A	296,835	442	71	186
WB9LTY	A	201,068	413	47	125
W9DWQ	A	180,761	309	66	151
WB9IWN	A	175,968	313	56	152
K9OTB	A	163,064	294	64	154
W9ZTD	A	122,304	249	55	127
WA9BHH	A	121,915	244	57	128
WA9RJI	A	104,340	221	58	130
WB9IYO	A	71,595	185	36	93
K9IKP	A	70,716	177	37	105
WB9MDB	A	67,050	170	48	102
W9JAY	A	50,625	108	42	83
K9EGH	A	41,800	137	33	77
W9BPU	A	28,405	108	25	70
W9LQ	A	27,846	91	33	84
WA6FXM/9	A	16,426	89	28	58
W9CRN	A	16,170	81	29	48
W9MDW	A	13,013	68	23	54
WB9KLW	A	11,850	66	32	47
W9OHH	**28**	**7,854**	**81**	**9**	**33**
W9BZW	"	2,944	42	9	23
WB9HAD	**21**	**188,625**	**526**	**27**	**98**
W9IY	"	125,073	382	25	92
W9YT	"	92,202	272	25	96
WB9EBO	"	59,052	191	23	88
WB9IJV	"	39,243	138	24	79
K9PQG	"	36,735	141	22	71
W9LKI	"	32,608	153	19	65
K9UKM	"	30,885	131	21	66
WB9KLB	"	25,730	125	23	60
WB9GVW	"	25,650	138	20	70
K9ARZ/9	"	18,414	108	15	47
WB9BSH	"	40	3	2	3
K9PPY	**14**	**314,440**	**774**	**31**	**109**
W9ZRX	"	230,298	610	30	101
W9YRA	"	198,561	566	26	95
WB9LHI	"	190,209	474	31	110
(Opr. K9TZH)					
WA9JDT	"	146,251	430	26	93
K9CLO	"	70,452	247	25	78
K9JDV	"	62,550	247	23	67
W9PJT	"	34,748	178	18	50
K9UIY	"	22,880	134	15	50
K9HKF	"	1,975	27	6	19
W9NZM	**7**	**32,485**	**138**	**24**	**64**
W9CH	"	26,364	125	20	58
WB9MOG	"	18,720	100	19	53
WB9NIB	"	10,584	84	16	38
WB9AJZ	"	6,076	47	15	34

WA2WMT/Ø	**A**	**680,208**	**820**	**95**	**201**
WAØONL	A	516,780	646	88	209
WAØCPX	A	391,391	487	94	205
WØIUB	A	231,549	363	69	168
WØFHE	A	217,607	335	74	173
WAØVDX	A	197,800	321	71	159
WBØFHH	A	132,660	279	53	127
WBØOAZ	A	84,106	199	56	106
KØCML	A	74,620	168	50	114
WØMIN	A	70,692	192	43	94
WØPUD	A	49,911	150	34	93
WAØAGN	A	48,013	147	46	87
WBØFZV/Ø	A	42,471	164	30	69
WØOWS	A	39,216	121	42	87
WØHUP	A	36,720	130	31	71
KØSVW	A	35,900	130	29	71
WØLJF	A	32,200	121	34	66
WBØHOG	A	26,085	87	36	75
WØBWJ	A	16,380	75	32	58
WAØBWF	A	13,035	93	23	32
WØAZT	A	12,714	66	32	46
WØMUH	A	10,472	57	24	53
WAØYJL	A	9,000	61	23	37
WAØFBQ	A	6,018	49	21	30
KØEGA	A	957	15	14	15
WAØVUY	A	777	13	7	14
KØGVG	**28**	**4,329**	**48**	**9**	**28**
WBØLLR	**21**	**151,018**	**524**	**27**	**71**
WBØMIV	"	92,966	355	25	69
(Opr. WB0QHV)					
WBØIKN	"	50,847	342	18	33
WØPCO	**14**	**198,152**	**529**	**31**	**105**
WAØYFW	"	116,202	387	29	78
(Opr. WB0NYY)					
KØFLY	"	52,800	211	27	61
KØEQY	"	16,225	102	14	41
WØAIH	"	6,765	50	16	39
WAØVPN	**3.8**	**5,206**	**60**	**12**	**26**
(Opr. WB0HCH)					

Alaska

KL7HCN	**A**	**656,557**	**1,184**	**53**	**134**
KL7IDH	"	50,875	316	20	35
WA3GHC/KL7	**21**	**29,601**	**460**	**11**	**12**

KL7GI	14	77,214	677	17	34
KL7IEG	"	1,875	58	8	7
KL7JDO	3.8	2,080	56	8	8
Barbados						
8P6AH	14	522,680	1,534	33	113
Bermuda						
VP9AD	A	59,893	269	36	65
VP9BK	A	330	16	5	5
Canada						
XN1AW	A	180,792	411	44	118
VE1EP	21	4,945	46	10	33
VE1AIH	3.5	41,662	249	14	60
VE2AYU	A	553,700	969	58	168
VE2WA	"	13,728	76	20	46
VE2DVF	14	151,508	614	23	75
XJ3HUM	A	927,638	1,282	76	217
(Opr. VE3BVD)					
XJ3EJK	"	79,056	203	34	110
VE3EZM	"	45,101	143	36	83
VE3BBH	28	48	4	2	4
XJ3GCO	"	183,980	593	23	99
VE3KZ	21	390,775	984	27	118
VE3CSN	"	23,584	122	18	49
VE3CMV	"	49,056	206	20	64
VE3DJF	"	53,337	261	20	49
XJ3WT	14	390,340	1,002	33	112
VE3BBN	"	53,392	360	17	54
VE7BWK/3	"				
		61,415	408	17	54
XJ3EDC					
	3.5	141,726	1,030	19	50
XJ3BMV					
	1.8	8,640	274	6	10
VE3ECP	"				
	1.8	2,754	162	4	5
VE4RP	A	174,582	450	54	105
VE4AE	"	13,940	87	25	43
VE4BJ	"	550	12	11	11
VE4SN	14	2,697	33	9	20
XJ5RA	A	403,788	1,088	54	107
VE5FK	"	7,742	68	20	29
VE6WX	3.5	29,450	283	17	33
XJ6MP	14	280,476	1,009	29	79
VE6APJ	"	123,085	485	27	76
XJ7WJ	A	734,383	1,452	78	143
(Opr. WA7UQV)					
VE7DAJ	A	318,024	865	42	84
XJ7AZC	"	65,600	296	28	52
VE7IQ	"	3,649	39	20	21
VE7BC	14	625,645	1,412	36	121
(Opr. VE7LB)					
VE7DSR	"	150,975	571	29	70
VE7DEW	"	96,416	377	24	68
Canal Zone					
KZ5JM	21	416,500	1,526	25	94
Costa Rica					
TI2WX	A	683,606	1,737	65	128
TI2VC	28	585	58	3	2
Dominican Republic					
HI8MOG	A	534,499	1,154	61	142
HI8XFD	"	232,470	1,037	36	69
HI8LC	3.5	19,935	215	10	35
El Salvador					
HU1DX	A	514,206	1,198	62	136
(Opr. YS1MAE)					
Grenada					
VP2G	A	4,245,813	4,350	107	322
(Opr. W5MYA)					
Guantanamo Bay					
KG4DS	A	300,409	871	55	108
Guatemala					
VE2AQS/TG9					
	A	1,045,520	1,727	81	199
Jamaica					
WB9AJF/6Y5					
	A	1,215,654	1,417	97	242
WB4SJG/6Y5	"	470,332	1,899	44	80
Mexico					
XE1LLS	A	122,404	387	49	93
Nicaragua					
YN1FWN	A	203,680	696	50	84
Puerto Rico					
KP4ECH	21	173,460	915	23	61
St. Lucia					
VP2LAW	A	40,868	598	19	15
St. Pierre Et Miquelon					
FPØMD	21	51,170	251	15	55
Virgin Islands					
KV4IJ	A	3,247,986	4,118	92	265
(Opr. K6SDR)					
LU2DC/KV4					
	14	289,692	1,067	27	90
KV4FZ	3.5	275,319	1,297	23	80

AFRICA

Angola					
CR6FW	28	279,680	823	25	90
CR6IK	14	842,394	1,611	39	147
Ascension Island					
ZD8AA	A	1,481,504	1,877	79	193
(Opr. WA4TLB)					
Canary Islands					
EA8JJ	21	455,975	1,327	26	89
Ivory Coast					
TU2DF	A	476,064	722	64	164
Madeira Islands					
DJ6QT/CT3					
	A	1,071,360	995	92	280
CT3BD	A	217,264	504	53	95
CT3BK	A	35,926	174	19	52
Morocco					
CN8HD	3.5	140,651	663	15	56
Mozambique					
C9MIZ	A	240,609	567	37	102
C9MJO	14	662,028	1,362	37	135
Rhodesia					
ZE8JD	A	143,055	323	55	98
VK6SM/ZE					
	A	10,122	83	17	25
Senegal					
6W8FP	A	2,596,186	2,261	107	282
Seychelles					
VQ9D	A	27,404	163	29	39
South Africa					
ZS6RM	A	108,360	264	44	96
ZS6YK	21	196,270	697	26	69

ASIA

Hong Kong					
VS6AF	14	32,864	236	26	53
India					
VU2DK	A	1,358,093	1,487	84	247
Iran					
EP2SN	A	881,600	1,107	74	216
EP2OD	A	175,395	406	49	116
EP2EJ	28	3,666	37	13	26
Israel					
WA2KGY/4X					
	21	119,232	501	19	62
Japan					
JA2HLX	A	504,160	1,083	45	115
JE1SSE	"	486,366	839	77	129
JA4BKL	"	286,832	512	70	127
JA6YDH	"	164,934	404	54	93
JA6CNL	"	105,963	23	54	89
JA2JAB	"	90,579	329	45	64
JA2DLM	"	57,885	240	34	51
JA1CFJ	"	47,472	184	40	52
JA7CDV	"	41,500	157	38	62
JAØAGA	"	35,340	130	42	53
JA6AP	"	34,560	184	25	39
JA3XRC	"	34,320	180	23	43
JA5MDU	"	31,406	142	35	47
JA1LVS	"	30,261	145	29	48
JE3CID	"	26,520	158	23	37
JA7DAH	"	24,192	150	25	31
JA8ERG	"	21,909	117	26	41
JA1IZ	"	21,056	114	26	38
JA4GXS	"	19,140	128	22	33
JA8OYC	"	17,360	111	24	32
JA3ELU	"	17,287	105	23	36
JE3MWB	"	15,198	106	20	31
JAØTKU	"	14,852	109	22	25
JR2FNL	"	14,850	101	20	30
JA1PUK	"	14,235	70	32	41
JA3UP	"	12,376	94	21	31
JH3AKD	"	11,742	72	22	35
JR3MVF	"	11,368	76	30	26
JA1BII	"	10,863	84	22	29
JA1SGU	"	3,536	54	15	11
JF1NCT	"	2,700	39	13	14
JE1KDM	"	966	25	7	7
JA2DOU	"	957	16	13	16
JH3UBF	"	902	18	12	10
JH6INJ	"	322	9	7	7
JA2DYI	28	10,143	82	19	30
JA6UBK	"	9,620	76	20	32
JH7KUP	"	6,909	58	21	28
JAØFMB	"	1,456	20	11	15
JA7CUK	"	273	8	7	6
JG1ECK					
	21	101,712	439	26	52
JA7AMK	"	97,482	444	27	50
JH1AHU	"	94,827	444	25	48
JH2MYN	"	90,741	396	30	57
JH1XHO	"	88,825	360	29	56
JAØURR	"	61,390	310	26	45
JHZHFD	"	43,884	223	26	43
JA7CXF	"	39,760	198	27	43
JA7NK/1	"				
		36,725	194	24	41
JH2DMY	"	31,590	166	22	44
JA8MKZ	"	29,400	130	29	55
JA1SHC	"	26,244	168	22	32
JH4IFF	"	25,760	200	17	39
JF1DYY	"	24,336	157	20	32
JA6EFT	"	21,783	144	20	33
JA9NGS	"	21,024	146	15	33
JA3BUB	"	17,501	99	18	25
JH2WMZ	"	15,984	118	18	30
JA8BEV	"	15,762	142	15	22
JH2IXQ	"	13,588	111	16	27
JH2IRH	"	13,250	92	20	33
JAØPEZ/1	"				
		12,236	112	18	20
JH2WIC	"	12,150	91	16	29
JG1UMO	"	11,704	105	16	22
JH2YJZ	"	11,000	90	16	28
JR2JZR	"	10,537	92	15	26
JI1NHA	"	9,996	98	13	21
JF1QJD	"	9,900	81	16	29
JH4DIT	"	9,758	100	11	23
JA7JND	"	9,686	117	16	13
JH7HKG	"	9,361	88	17	20
JA6LCJ	"	6,604	127	19	33
JR2PPP	"	6,541	73	11	20
JA8FDB	"	6,528	68	13	19
JH3SBC	"	6,324	102	12	14
JF1SEK	"	6,216	74	12	16
JA7JGD	"	5,725	80	13	12
JA2ATE	"	5,400	66	14	17
JH4ARN		5,280	58	12	20
JA1OBW	"	4,611	54	14	15
JA9CVY	"	4,371	51	14	17
JA9IRH	"	4,292	52	13	16
JA1IRQ	"	3,384	48	11	13
JH4FRN	"	2,910	34	12	18
JR2HDS	"	2,295	45	7	10
JA9MMA	"	2,160	33	9	15
JA1RLR	"	1,717	35	8	9
JF1FTU	"	1,475	22	11	14
JR3CVO	"	1,296	36	6	6
JA3YJQ	"	1,273	23	10	9
JH7BOW	"	660	21	6	6
JA5PXG	"	504	14	7	7
JE1WIH	"	378	15	5	4
JAØUXG	"	272	12	4	4
JH4MVB	"	270	18	3	2
JH3FYW	"	228	7	6	6
JH4MVA	"	168	8	3	4
JASNYD	"	90	5	3	3
JI1CMZ	"	12	2	1	1
JH1ECG	14	422,675	988	37	108
JA9AG	"	290,520	826	33	87
JA1HVS	"	85,624	399	26	51
JA1NVF	"	74,790	290	30	60
JA1SKE	"	71,546	305	27	56
JAØAIE	"	45,114	223	25	48
JA1IST	"	44,640	174	24	63
JAØSC	"	37,765	212	31	41
JA2INS	"	35,244	137	20	58
JA7YOJ	"	24,090	160	20	35
(Opr. JA7GQB)					
JA6CM	"	23,800	155	21	35
JH1MTR	"	21,240	137	22	38
JH6CAW	"	19,504	135	21	32
JG1UNF	"	18,928	127	19	33
JA1LDJ	"	18,260	125	21	34
JF1RWZ	"	18,144	128	23	31
JF1INA	"	11,616	105	20	24
JA2BNN	"	11,076	121	20	20
JA6UYF	"	10,761	79	22	30
JA3AHD	"	8,256	66	17	26
JA1AAT	"	7,810	61	31	24
JRZBDF	"	7,680	74	18	22
JA4ERX	"	6,480	66	18	22
JAØCAF	"	6,300	65	16	20
JA3BX	"	5,888	50	19	27
JA1JLL	"	5,236	58	16	18
JH7BRG	"	3,072	32	13	19
JH4CQQ	"	3,036	42	15	18
JA4EE	"	3,016	40	14	12
JA2JOJ	"	2,688	34	16	16
JA5AF	"	2,464	34	14	18
JE2AIN	"	1,683	51	14	19
JA1ALX	"	1,508	23	12	14
JE1LES	"	1,176	34	7	7
JAZRFG	"	1,166	19	9	13
JRZAQP	"	1,122	17	9	13
JA7KM	"	880	21	8	8
JA1EDH	"	780	18	9	6
JA4DZ	"	696	29	4	4
JA6YY	"	486	18	4	5
JA6EYD	"	480	10	8	8
JAØGZ	"	400	14	6	4
JA3EQC	"	144	8	3	3
JA6JAV	"	55	5	3	2
JA2BET	7	83,187	358	27	54
JA1MCU	"	21,645	120	23	42
JA4FCR	"	6,055	64	17	18
JA2INO	"	5,696	67	15	17
JA1JID	"	5,017	64	13	16
JA1CWZ	"	3,024	48	9	12
JA2AIR	"	902	30	6	5
JH4ADF	"	896	25	8	6
JA8BKI	"	480	33	3	2
JF1AWP	"	260	18	3	2
JH3BJN/4	"				
		28	3	2	2
JA6BSM					
	3.5	6,882	65	16	21
KA6DX	14	5,148	61	16	23
Korea					
HL9TB	A	293,553	700	86	107
Republic of China					
BV2B	14	16,360	317	18	22
Singapore					
9V1SH	28	23,958	175	21	45
West Malaysia					
9M2FK	A	10,944	65	31	41

USSR

Armenia					
UG6GAF	14	183,090	668	27	75
Asiatic U.S.S.R.					
UA9OO	A	532,078	984	59	164
UA9ADF	A	138,592	410	29	93
UA9YE	A	24,318	241	23	40
UW9SG	A	16,131	94	14	43
UA9FU	A	12,383	71	19	42
UW9TZ	A	11,648	73	24	40
UA9WCQ	A	6,162	65	15	24
UA9F8M	A	5,945	56	13	28
UA9CFC	28	14,214	119	14	32
RA9ODC	28	5,394	79	10	21
RA9CAS	28	4,100	56	7	18
UA9YBY	28	2,057	48	6	11
UA9TS	21	109,434	620	19	59
UW9CL	21	92,560	495	22	58
UA9MDY	21	18,810	261	9	29
UA9HAV	21	14,732	240	7	22
UA9MS	14	329,014	926	87	105
UA9UF	14	120,096	530	34	74
UA9FAJ	14	77,868	334	22	62
UA9IF	14	67,704	345	25	59
UA9FBC	14	10,152	216	15	32
UA9CBW	14	8,029	76	9	28
UA9CAM	14	4,000	45	9	23
UA9MT	14	1,760	23	13	19
UA9VX	14	240	8	5	7
UV9FN	14	168	8	3	4
UA9WS	7	32,400	231	11	39
UA9CBO	7	15,087	117	12	35
UA9AAP	7	8,514	106	7	26
UK9ADT	3.5	40,893	339	8	35
(Opr. UA9ADQ)					
UA9NP	3.5	3,198	50	6	20
RAØLFI	28	2,760	68	14	16
UAØCBW	21	24,058	285	16	30
UVØEX	14	189,725	934	27	68
UWØIQ	14	72,157	594	21	38
UAØFBZ	14	18,998	412	11	12
UAØBAC	14	17,864	155	12	32
UAØJAD	14	10,680	169	14	26
UAØCBO	14	994	66	5	9
UAØCAH	14	825	21	6	9
UAØFCK	7	7,068	360	10	9
Azerbaijan					
UD6DER	A	129,000	328	44	106
UD6CN	"	17,172	121	14	40
UD6DHW	21	5,148	57	7	26
Georgia					
UF6DZ	A	169,094	508	29	89
Kazakh					
UL7OAO	A	765,408	1,064	71	201
UL7LAW	"	411,281	709	62	159
UL7PQ	"	17,334	214	30	51
UL7PAT	"	14,809	123	21	38
UL7PBY	28	32,945	253	13	42
UL7WI	21	7,072	208	8	26
UL7EAJ	14	113,524	438	26	75
UL7OE	"	102,623	429	24	69
UL7YR	"	57,316	245	28	64
UL7NAC	"	10,535	114	9	26
UL7JAW	7	15,390	223	10	28
Kirghiz					
UM8FM	A	209,919	507	47	120
UM8MAS					
	3.8	1,287	43	5	8
Tadzik					
RI8JBJ	28	2,880	45	12	20
UJ8JJJ	21	21,996	240	9	27
UJ8JGJ	7	23,568	257	11	37
Turkoman					
UH8BO	21	1,296	20	8	16
Uzbek					
UI8CD	14	230,496	738	32	80
UI8LAG					
	3.8	24,354	219	10	31

EUROPE

Aland Is.					
OHØNI	14	236,848	1,027	29	84
OHØNJ	7	22,223	137	15	56
Austria					
OE5CWL	A	98,800	470	36	116
OE3WWB	A	96,714	246	68	131
OE2RIL	"	27,824	201	26	68
OE1SBA	A	9,856	64	29	48
OE1ZGA	21	74,632	201	33	119
Belgium					
ON4XG	A	90,013	298	48	119
ON8ZI	21	113,187	507	24	63
ON5KY	14	387,126	1,141	30	104
Bulgaria					
LZ1QO	A	261,970	632	67	163
LZ2JF	A	60,630	329	40	89
LZ2KSU	"	21,420	179	22	62
LZ1MH	"	18,860	211	18	64
LZ7KST	"	15,040	128	25	55
LZ1CN	"	3,131	51	11	20
LZ2EE	21	263,580	974	28	87
LZ2KSG	"	1,450	20	11	14
LZ1TD	14	3,162	82	7	27
LZ1QR	3.5	8,229	206	8	31
Channel Is. (Jersey)					
GC5AGA	A	460,596	836	55	138
Czechoslovakia					
OK2RZ	A	1,531,868	1,819	89	267
OK1AGQ	A	714,009	1,161	71	212
OK1ADM	"	159,334	264	83	183
OK2KR	"	97,745	396	44	129
OK2BIH	"	94,106	452	37	94
OK1AGN	"	85,065	322	45	114
OK1DA	"	70,757	232	49	124
OK1CFH	"	36,260	232	22	48
OK2SPS	"	30,090	248	25	77
OK1KZ	"	28,885	247	26	83
OK2ZU	"	26,082	185	26	55
OK2BEF	"	14,325	181	15	60
OK2PBG	"	12,672	162	16	56
OK2BLG	"	11,550	94	24	53
OK1BLC	"	3,705	51	19	38
OK1DK	"	80	6	4	6
OK1MGW					
	28	1,449	23	7	16
OK2ABU	"	54	6	4	5
OK3EA	21	258,944	741	30	106
OK3WM	21	176,640	531	30	98
OK3CMW	"				
		31,363	155	26	53
OK2SLS	"	20,350	125	20	54
OK1MPP	"	19,462	99	25	49
OK1ASQ	"	16,616	107	20	47
OK1SV	"	14,832	72	27	45
OK1AHV	"	5,566	51	17	29
OK1AVU					
	14	105,395	436	25	82
OK1DVK	"	18,768	157	20	49
OK1PCL	"	9,918	102	15	43
OK1AAA	"	3,087	63	10	39
OK1KUR	"	1,066	36	7	19
OK1ATE	"	1,045	77	18	32
OK1MP	7	13,824	160	15	49
OK2BNK	"	1,896	79	9	15
OK1DWA	"	495	33	2	13
OK2BIQ					
	3.5	21,150	363	10	40
OK1IMP	"	6,018	168	6	28
OK1KIR	"	4,672	147	4	28
OK2HI	"	4,230	147	5	25
OK2QX	"	3,720	120	5	26
OK1KTA	"	3,710	104	6	29
OK2BBJ	"	2,158	81	5	21
OK1JVP	"	1,122	54	4	18
OK2SBB	"	585	40	3	12
OK1MNV	"	462	33	2	12
OK2SKU	"	425	26	3	14
Denmark					
OZ3KE	A	54,543	219	46	98
OZ3PO	"	36,540	124	45	81
OZ7BG	"	20,172	103	31	51
OZ7HT	"	17,963	92	28	43
OZ6QE	"	15,876	107	27	54
OZ5ME	"	13,651	103	26	47
OZ8BZ	"	10,744	86	26	53
OZ1ZE/P	"				
		9,882	58	32	49
OZ4HW	"	9,090	69	27	63
OZ7HX	"	1,824	35	15	23
OZ1LO	"	1,440	16	5	6
OZ5FK	28	357	13	7	10
OZ2PG	14	315,332	998	32	92
OZ5KF	7	88,740	538	24	63
OZ5EV	"	23,851	352	13	48
OZ6XR	"	16,695	298	10	43
England					
G3LNS	A	2,595,692	2,676	90	256
G3TXF	"	303,438	578	77	232
G3YBH	"	156,252	408	49	125
G3NFV	"	121,270	346	47	134
G4DJZ	"	46,440	212	43	86
G2AJB	"	24,750	119	26	73
G4BBA	"	20,570	110	33	88
G4DXW	"	5,609	56	21	50
G3SGC	"	884	20	11	15
G4CQM	28	15,066	181	18	44
G2BOZ	"	14,694	163	17	45
G3WJN	21	533,943	1,563	31	92
G3XYP	14	810,434	1,999	37	120
G3HCT	"	704,459	1,688	33	124
G4DJC	"	390,222	1,294	29	85
G5BEF	14	217,256	786	30	74
G4CVZ	"	37,940	371	18	52
G4AMT	7	44,748	291	16	50
G4DKT	3.5	19,581	265	11	50
G4BXT	1.8	992	52	4	12
G3YMC	"	518	38	2	12
Faroe Is.					
OY1A	14	4,984	79	6	23
Finland					
OH7OK	A	353,962	946	70	192
OH7UE	A	120,080	439	46	112
OH3OF	"	38,454	213	33	69
OH7NW	"	34,270	200	35	80
OH2EQ	"	13,671	77	30	33
OH3HS	"	10,212	107	23	51
OH2VZ	"	8,142	81	21	38
OH2NP	"	5,096	36	18	34
OH9TD	"	3,111	44	14	37
OH3TY	"	2,220	22	15	22
OH2DN	"	2,120	29	15	25
OH7NJ	"	1,890	39	15	27
OH2BLU	"	928	22	11	17
OH2BFX	"	216	30	8	18
OH3XZ	28	28,944	271	17	50
OH2BAH	"	5,550	62	14	36
OH2OM	"	2,613	47	11	28
OH2XA	"	2,296	53	7	21
OH7SX	"	18	3	3	3
OH2BZ	21	332,920	885	32	113
OH2XF	"	67,144	285	29	80
OH1KF	"	40,850	222	23	63
(Opr. OH2KE)					
OH5PA	"	28,560	192	21	59
OH4SL	"	18,800	90	26	54
OH5YF	"	14,520	99	16	39
OH2BMG	"	351	9	5	8
OH2BH	14	981,815	2,098	37	142
OH2LU	"	297,720	1,019	29	91
OH1IG	"	296,514	1,129	31	83
OH1MA	"	119,483	482	26	65
OH6LV	"	84,006	504	20	58
OH2BCD	"	2,170	37	11	20
OH2BMP	"	1,488	22	11	13
OH3ZH/1	"				
		930	25	7	23
OH8OH	"	456	12	8	11
OH1PG	"	192	16	3	9
OH2BFS	"	84	4	3	4
OH5NW	7	167,751	798	29	80
OH1IJ	"	66,033	484	23	64
OH1XX	3.5	71,640	646	20	70
OH2BO	1.8	1,144	91	2	11
OH1VP/3	"				
		611	53	2	11
France					
F6BFH	A	449,520	730	65	175
F8WE	"	170,676	616	50	148
F8RU	"	72,663	177	55	104
FØBYR	"	44,704	241	33	94
F8TM	"	37,524	192	36	82
F3IJ	"	12,351	79	31	38
F6DDP	"	12,232	148	12	33
F2RO	"	8,701	91	22	33
F5RD	"	5,382	97	10	36
F6ARC	21	217,566	803	29	73
F6CLM	"	2,886	41	12	14
FØBHC	14	6,437	103	13	28
Germany (DDR)					
DM2AUF	A	88,356	184	64	135
DM2DEO	"	61,408	300	36	116
DM6TAH	"	39,324	301	28	85
DM4SDA	"	37,968	265	30	82
DM5YVL	"	28,170	189	28	62
DM4YEL	"	12,638	117	21	50
DM2FDO	"	11,972	103	29	53
DM3EA	"	9,588	57	31	37

JH1ECG

I4ZSQ

XJ3BMV

DM3CF	"	2,560	48	12	28
DM4BK	"	1,428	49	8	20
DM4JN	"	441	21	7	14
DM3XQD					
	28	**527**	**25**	**5**	**12**
DM2DGO					
	21	**297,476**	**936**	**30**	**94**
DM3PCK					
	14	**42,558**	**310**	**20**	**62**
DM4UEE	**7**	**6,006**	**126**	**9**	**33**
DM2BOO	"	2,200	90	3	22
DM2BPB	"	1,020	52	3	17
DM5UFD					
	3.5	**18,225**	**357**	**8**	**37**
DM4XPF	"	782	47	4	13
DM3UFJ	"	735	35	4	17
DM2CJF	"	360	30	2	10
DM5BH	"	15	3	2	3
Germany (FRG)					
DK3GI	**A**				
		1,458,847	**1,654**	**95**	**288**
DJ4ZR	**A**	**764,154**	**1,095**	**73**	**194**
DL8PC	**A**	**743,015**	**986**	**98**	**257**
DJ5JH	"	723,520	927	77	227
DJ9MH	"	699,125	994	86	243
DJ1ZN	"	474,012	596	88	254
DJ2TI	"	460,559	746	78	203
DK8EY	"	455,598	835	72	162
DK5PR	"	445,947	728	75	206
DL8YR	"	255,255	522	66	165
DK8MA	"	180,774	474	1	115
DL3PN	"	160,888	424	57	112
DL7SP	"	149,248	362	56	156
DL7RT	"	141,702	413	61	148
DFØAFZ	"	137,808	385	54	144
			(Opr. DL3ZI)		
DL1YA	"	120,771	346	51	138
DK6PW	"	96,990	363	53	130
DL1MD	"	89,916	267	48	129
DJ2UU	"	75,852	262	51	121
DL7EN	"	72,216	173	52	125
DL8AJ	"	62,300	255	40	100
DJ8OL	"	61,593	221	43	104
DK8KC	"	49,536	276	31	97
DK3KD	"	38,829	204	35	94
DK9SG	"	30,912	168	32	64
DK2WY	"	28,764	124	33	69
DK5WQ	"	27,405	161	32	73
DK5KJ	"	22,700	152	32	68
DF2QA	"	21,312	184	26	70
DK9NY	"	17,888	147	27	59
DK8KD	"	15,340	110	23	42
DJ4AN	"	14,062	131	23	66
DF4QM	"	5,715	83	19	26
DK6CS	"	4,841	63	17	30
DF6QC	"	3,960	73	14	31
DJ8OT	"	2,160	32	11	19
DL7QG	"	1,242	22	11	12
DL3UP	"	760	17	7	12
DL9VS	**28**	**15,594**	**127**	**20**	**49**
DL1ED	"	7,049	76	15	38
DJØXT	**21**	**209,781**	**691**	**30**	**87**
DJ1ZUA	"	135,488	434	28	88
DK8FC	"	134,264	461	28	76
DJ2QH	"	91,001	330	30	71
DK7RR	"	81,972	374	26	55
DJ9ZB	"	80,878	300	29	80
DL1IP	"	32,376	224	22	49
DF3QG	"	27,090	180	22	48
DL1RB	"	18,282	118	22	44
DL5RF	"	6,900	46	24	36
			(Opr. DA2RK)		
DK8DS	"	3,150	43	12	18
DK4OO	**14**	**523,050**	**1,331**	**37**	**113**
DF1QQ	"	91,280	437	23	57
DL3AH	"	61,370	278	25	70
DL9SNA	"	52,632	226	26	72
DL2JX	"	35,420	259	18	59
DL1AMA	"	4,108	47	13	39
DJ3BZ	"	1,980	47	9	21
DK3OI	14	792	23	9	15
DJ6LV	**7**	**44,874**	**406**	**18**	**63**
DJ4PI	"	28,269	251	20	61
DK7PI	"	19,551	299	11	46
DK8BI	"	9,160	215	7	33
DK5VO	"	7,216	171	7	34
DK3FB	**3.5**	**52,672**	**640**	**15**	**49**
DK3SN	"	42,900	528	12	54
DJ6TK	"	20,515	309	10	45
Greece					
SVØWJJ	**14**	**118,198**	**790**	**32**	**81**
Hungary					
HAØKLU	**A**	**188,538**	**562**	**54**	**147**
			(Opr. HA0MM)		
HA1ZD	A	35,280	238	27	78
HAØKLL	A	13,608	121	19	44
HG5EA	**28**	**2,346**	**57**	**8**	**26**
HA6NP	**21**	**55,710**	**286**	**23**	**67**
HA9RU	**3.5**	**35,086**	**550**	**11**	**42**
HA5KKO					
	3.5	22,330	403	9	46
Iceland					
TF3HP	**A**	**36,176**	**408**	**18**	**58**
TF3IRA	A	15,447	181	19	38
			(Opr. TF3KB)		
Ireland					
EI2BB	**A**	**220,802**	**549**	**46**	**180**
EI2CA	**14**	**233,696**	**1,134**	**24**	**85**
Isle of Man					
GD5DZ	**A**	**66,700**	**431**	**22**	**36**
Italy					
I4BNR	**A**				
		1,386,000	**1590**	**91**	**239**
IV3VLS	**A**				
		1,260,345	**1492**	**98**	**267**
			(Opr. I3PRK)		
I6FLD	A				
		1,210,788	1599	92	241
I4ZSQ	A				
		1,136,850	1487	90	240
I1DOZ	A				
		1,031,484	1467	67	191
I3LDP	A	271,237	600	57	142
IC8EGO	A	216,972	703	47	149
I3GRX	A	123,620	382	43	97
I4CSP	A	45,426	245	41	93
I3DAB	**28**	**47,304**	**249**	**27**	**81**
I2TTL	**21**	**239,682**	**712**	**33**	**96**
IØOU	**21**	**223,500**	**707**	**28**	**97**
I4DVT	21	167,400	598	26	81
I2AT	21	134,232	503	26	76
I4PZP	21	125,048	517	28	70
I3BYT	21	105,800	458	25	67
IØGFT	21	79,800	329	27	73
I3BBZ	21	64,770	265	28	74
I3OSM	21	30,500	220	18	43
I8ZLW	21	28,840	251	17	49
IØNSA	21	5,203	56	17	26
I1GPK	**14**	**710,646**	**1664**	**37**	**129**
I5WCN	14	123,703	623	25	78
I5FCK	7	92,904	408	22	76
I3MAU	3.5	113,535	778	18	69
I2FUD	3.5	8,000	195	6	34
Luxembourg					
LX1BW	**A**	**460,350**	**957**	**46**	**140**
LX1MK	A	14,112	125	19	53
Malta					
9H1CH	**28**	**22,050**	**208**	**17**	**53**
Market Reef					
OJØMA	**A**	**487,795**	**1274**	**61**	**184**
Monaco					
3A2GX	**14**	**384,252**	**2343**	**34**	**130**
Netherlands					
PA9TOM	**A**	**583,968**	**1178**	**59**	**205**
PAØAGA	**A**	**583,943**	**1167**	**61**	**180**
PAØTAU	A	400,488	674	74	190
PAØJR	A	6,111	57	20	43
PAØEHF	**21**	**35,217**	**162**	**24**	**67**
PI1ARS	21	18,144	144	20	36
PAØJR	14	7,314	57	23	30
PAØLVK	14	4,352	78	9	23
PAØTO	14	2,940	55	8	27
PA7GBY	14	1,196	20	11	12
PAØHIP	**1.8**	**3,024**	**149**	**3**	**15**
Norway					
LA2DR	**A**	**112,320**	**346**	**51**	**129**
LA4TG	A	90,768	393	31	93
LA3RP	A	64,239	323	37	96
LA5JS	A	58,293	267	37	90
LA2YT	A	21,420	199	25	77
LA4LN	A	17,136	93	29	39
LA1R	A	15,975	124	24	51
			(Opr. LA9RT)		
LA2IE	A	13,362	107	22	29
LA5QK	A	6,466	76	21	40
LA8LT	A	4,875	109	8	31
LA7KK	A	3,060	42	16	18
LA1YS	A	1,092	30	7	19
LA6HL	**21**	**34,290**	**256**	**13**	**32**
LA9TI	21	10,985	69	20	45
LA55H	21	4,240	36	20	33
LA7FJ	21	1,742	63	5	21
LA4AT	**14**	**50,025**	**331**	**18**	**57**
LA7FD	14	17,748	100	20	67
LA3UQ	14	1,288	25	9	14
LA1KQ	14	580	23	7	13
Poland					
SP9AI	**A**	**610,878**	**1063**	**81**	**237**
SP9CTW	A	314,426	649	64	195
SP5XM	A	222,835	646	52	153
SP5BB	A	103,840	397	44	132
SP8ECV	A	70,832	393	33	119
SP9BLF	A	68,160	359	34	108
SP6AYP/9					
	A	29,268	219	28	80
SP9EWM	A	23,600	201	23	77
SP5BT	A	20,056	95	36	56
SP9HWT	A	17,255	181	20	65
SP6DB	A	15,744	116	29	67
SP3CDQ	A	12,474	130	22	55
SP9BDQ	A	11,537	111	23	60
SP9AVZ	A	9,593	170	11	42
SP3AGE	A	7,316	44	21	38
SP9BBH	A	6,867	107	13	50
SP3FRF	A	3,237	78	11	28
SP3DGT	A	2,847	39	14	25
SP1EOI	A	2,380	65	8	27
SP6FJG	A	1,720	47	8	12
SP7FQI	A	1,107	35	9	18
SP3DOI	**28**	**11,968**	**87**	**20**	**48**
SP5DDJ	28	945	34	5	16
SP9ZD	28	42	4	3	4
SP4AS	**21**	**76,255**	**399**	**25**	**76**
SP4CMY	21	45,756	290	23	53
SP3GEM	21	38,480	184	23	57
SP5BAK	21	36,640	203	23	57
SP8AWL	21	8,183	94	14	35
SP6CPM	21	2,492	47	9	19
SP5GKN	21	558	13	8	10
SP5CUK	21	375	13	6	13
SP7HT	**14**	**115,128**	**479**	**30**	**93**
SP8ARY	14	98,200	557	24	76
SP4CLX	14	90,882	530	26	73
SP5EAQ	14	49,980	399	23	61
SP9EVP	14	40,180	190	25	73
SP5ENM	14	38,700	261	25	65
SP9KGC	14	28,342	251	19	55
SP9FLY	14	27,258	214	24	53
SP2BSX	14	27,280	161	20	40
SP7ETG	14	18,660	198	14	46
SP6ECA	14	11,088	155	14	42
SP5GOP	14	6,390	155	9	21
SP8HXN	14	3,096	85	7	29
SP7ASZ	14	1,550	31	9	22
SP9ABU	**7**	**3,596**	**118**	**5**	**24**
SP6AGD	7	1,150	51	4	19
SP2FAP	7	442	29	4	13
SP2GUB	7	36	7	2	4
SP5ELA/5					
	3.5	**29,892**	**402**	**11**	**42**
SP6KAJ	3.5	12,628	303	8	33
SP2BBD	3.5	11,395	192	8	35
SP6AFO	3.5	9,065	277	5	30
SP3IBS	3.5	5,510	193	4	25
SP9AKD	3.5	2,670	90	5	25
SP1EIC	3.5	1,176	59	4	17
SP4EXN	3.5	800	48	4	12
SP8RJ	3.5	459	28	4	13
Portugal					
CT1DW	**A**	**111,134**	**393**	**46**	**135**
CT1AV	**14**	**96,163**	**512**	**23**	**90**
CT1QZ	14	86,580	504	19	59
Romania					
YO6KAF	**A**	**170,482**	**517**	**48**	**110**
YO5BQ	**A**	**165,212**	**536**	**51**	**155**
YO6EX	A	81,305	281	48	113
YO3RF	A	40,424	172	41	83
YO9KAG	A	28,188	221	24	84
YO6MD	A	26,386	234	21	58
YO7APM	A	24,440	211	31	63
YO3QK	A	24,030	144	27	62
YO8AKA	A	22,923	253	20	61
YO7NA	A	15,836	151	16	58
YO3AC	A	7,065	65	16	29
YO7KAJ	A	1,950	39	13	26
YO3ZP	A	540	11	9	11
YO2BIW	A	475	26	6	13
YO7IY	A	380	19	6	13
YO4AYE	**14**	**16,936**	**209**	**10**	**48**
YO3GK	14	4,698	50	12	42
YO4UJ	**7**	**8,148**	**160**	**8**	**34**
YO3JW	**3.5**	**43,072**	**586**	**13**	**51**
YO6VZ	"	1,804	82	4	18
Scotland					
GM3BCL	**A**	**113,393**	**342**	**52**	**115**
GM4ENN	A	6,240	114	9	31
GM4CHX	**14**	**13,072**	**211**	**12**	**31**
GM3SSB	14	12,264	139	14	42
GM3YOR	**1.8**	**1,358**	**102**	**2**	**12**
Shetland Islands					
GM3RFR	**21**	**10,191**	**114**	**13**	**30**
Sicily					
IT9MPR	**A**	**128,464**	**508**	**41**	**71**
IT9WGI	**28**	**22,847**	**241**	**19**	**48**
Spain					
EA7CP	**A**	**45,120**	**201**	**38**	**82**
EA3NA	**21**	**74,690**	**371**	**27**	**83**
EA3OJ	21	38,675	296	22	63
EA2IA	**14**	**1,938**	**46**	**6**	**13**
Svalbard					
JW5NM	**A**	**169,510**	**527**	**37**	**97**
Sweden					
SM3BIZ	**A**	**455,270**	**814**	**69**	**196**
SMØAJU	A	256,855	542	64	171
SM5EEP	A	193,380	604	50	115
SM5CAK	A	103,005	287	47	88
SM2DMU	A	38,016	128	55	121
SM7TV	A	37,840	199	36	74
SMØBSC	A	21,082	167	28	55
SM5RE	A	15,957	135	27	54
SM7BYP	A	12,285	77	24	39
SM7BGF	A	11,564	128	20	39
SMØCGO	A	9,196	95	24	52
SL7DM	A	6,328	73	16	40
SM4AZD	A	5,000	53	17	33
SM7BBV	**A**	**1,080**	**15**	**5**	**4**
SM5DUS					
	28	1,560	37	9	17
SM5BRW					
	21	**54,900**	**260**	**25**	**75**
SM6ID	21	2,668	41	11	18
SMØKV/Ø	"				
		2,013	29	10	23
SM5BNZ					
	14	**390,128**	**1,169**	**33**	**115**
SM7DMN					
	14	235,094	912	28	94
SM3DSP					
	14	167,827	637	30	91
SM2DHG					
	14	7,650	88	14	36
SM5GA	14	4,958	73	10	27
SM7FYM					
	14	2,912	37	13	19
SM6CNX					
	14	1,710	32	9	10
SM7CUY	14	875	19	9	16
SM5DLR					
	14	98	8	3	4
SM6DVZ					
	14	35	5	3	4
SM4CAN	**7**	**50,743**	**466**	**21**	**56**
SMØTW	7	16,128	253	13	43
SM5GZ	**3.5**	**47,068**	**436**	**18**	**64**
Switzerland					
HB9ZE	**A**	**284,096**	**666**	**47**	**146**
HB9UD	A	6,758	80	24	38
HB9DX	**21**	**28,975**	**113**	**25**	**70**
Wales					
GW3MUZ/M					
	A	2,232	44	10	21
GW4CYD	**28**	**12,084**	**146**	**16**	**41**
GW3NNF	**21**	**206,240**	**796**	**24**	**71**
GW3SLA	**14**	**13,630**	**145**	**15**	**43**
Yugoslavia					
YZ2OB	**A**	**609,900**	**1,097**	**77**	**208**
YZ1INO	A	298,552	863	56	212
YZ3CM	A	155,414	448	58	180
YZ1UM	A	131,157	468	60	117
YZ1NZW	A	80,032	311	46	118
YZ1NPG	A	64,902	201	50	124
YZ1US	A	23,716	137	38	39
YZ3TFB	A	21,049	103	34	63
YZ3RMS	A	8,308	85	21	41
YZ1AAO	A	2,178	58	8	25
YZ1SF	A	399	15	7	14
YZ2CBE	**28**	**10,244**	**148**	**13**	**39**
YZØSRJ	21	422,816	1,192	34	112
YZ1OBA	21	91,500	561	23	52
YZ2RLK	21	41,850	207	20	70
YZ1OFT	21	6,642	134	12	29
YZ2RNE	**14**	**662,004**	**1,924**	**35**	**113**
YZ4EBL	14	399,938	1,234	36	118
			(Opr. YZ4VFF)		
YZ1BCD	**7**	**149,600**	**756**	**28**	**82**
YZ3TPM	7	88,954	641	19	60
YZ3TKT					
	3.5	**26,975**	**366**	**12**	**53**
YZ3TCQ					
	3.5	6,422	166	6	32

USSR

Byelo Russia					
UC2ICJ	**A**	**76,250**	**402**	**31**	**94**
UC2IJ	"	72,884	445	32	107
UC2BF	21	24	2	2	2
UC2WP	**21**	**3,048**	**97**	**6**	**18**
UC2AAX					
	3.8	**7,378**	**232**	**5**	**29**
Estonia					
UR2QI	**A**	**707,808**	**1,263**	**71**	**221**
UK2RIL	"	80,600	483	31	93
UR2LH	"	8,600	80	16	27
UR2TAX					
	28	**15,860**	**179**	**16**	**49**
UR2MG	**21**	**204,402**	**815**	**29**	**85**
UR2REZ	"	20,732	153	21	52
UR2GD	**14**	**423,654**	**1,441**	**32**	**99**
UR2EG	"	105	7	3	4
UR2TAU					
	3.8	**6,534**	**196**	**5**	**28**
UR2CR	"	551	30	4	15
Latvia					
UQ2DV	**A**	**47,600**	**232**	**43**	**97**
UQ2GA	**28**	**7,266**	**113**	**13**	**29**
UQ2HO	**14**	**34,128**	**327**	**18**	**54**
UQ2CR	**7**	**4,114**	**113**	**6**	**28**
UQ2GW	"	1,944	43	8	28
UQ2GCN					
	3.8	**15,750**	**327**	**8**	**34**
UQ2GDQ	"	7,955	207	6	31
Lithuania					
UP2NK	**A**				
		1,316,484	**1,718**	**90**	**258**
UP2OU	"	**524,250**	**1,308**	**72**	**191**
UP2SA	"	405,809	882	70	193
UP2BAR	"	245,937	851	56	163
UP2CY	"	188,870	621	53	149
UP2OM	"	118,800	514	36	96
UP2NO	"	11,304	119	52	157
RP2PEJ					
	28	**4,860**	**107**	**11**	**25**
UP2ND	"	2,403	82	7	20
UP2AS	"	1,978	76	6	17
RP2PEC	"	280	23	4	6
UP2PAP					
	21	**42,080**	**230**	**22**	**58**
UP2BAS	**7**	**2,781**	**99**	**5**	**22**
UP2PAX	"	2,376	101	3	21
UP2PBW					
	3.8	**18,084**	**374**	**7**	**37**
UP2BAA	"	**15,120**	**319**	**8**	**32**
UP2BAT	"	9,282	226	6	33
UP2PCH	"	540	30	4	14
UP2BCJ	"	495	31	4	11
Kaliningrad					
UA2FC	**A**	**201,593**	**555**	**59**	**158**
Moldavia					
UO5OWK	**A**	**64,768**	**250**	**37**	**91**
UO5OGE					
	28	**34,360**	**359**	**17**	**41**

(Continued on page 70)

Taking Some Of The Mystery Out Of What's Going On Even Though Nothing Lights Up

Making IC Projects Work

BY LEONARD M. BUTSCH, JR., K4CNP

Foreward

A few rules govern the probability of success or failure of home grown solid state projects. They include (1) understanding generally what the electronic system is supposed to do, (2) what function(s) each of its' sub-systems or building blocks is supposed to perform, (3) that all components are operable and are in fact operating in the system within their specifications, (4) that construction errors are avoided to the extent possible during the building operation, and when or if found corrected and (5) a systematic debugging procedure is developed and used. These rules may appear overwhelming for medium and large intergrated circuit and/or solid state projects, but in fact are only sizeable rather than awesome when taken one at a time and broken down into bite size chunks. This is the purpose of this discussion. In addition, a suspicious nature on the part of the builder can be an asset, nothing being error proof, including the printed word. In fact, authors and editors will be the first to acknowledge that almost inevitably errors do creep into the final printed article for that new solid state project that the reader decides to build. Components are not always as labeled, wires accidentally go to the wrong places in schematic diagrams and a host of like gremlins manage to find their way into print. After the reader has built his solid state system an entire new set of possible errors that may cause failure arises such as cold-solder joints, solder bridges, connecting polarized components backward and plugging integrated circuits in backward to name a few.

It is hoped that this article will provide some guidance for the builder of solid state projects of medium to large size, such as those referenced[1] in the article and of great interest to many amateurs both of the "do it yourself" class and the "of interest" only class. Each of the rules listed above will be discussed and analyzed to "de-bunk", I hope, the air of mystery attached to making large IC systems work as they should. This is the first part of a two part paper that covers the organization, construction and debugging of IC projects that are currently of interest to amateurs with the emphasis on How To Make It Work.

There is an increasing emphasis of the use of solid state electronic hardware in amateur radio equipment due to a combination of circumstances such as low equipment or parts cost for IC's and transistors, a desire to make amateur equipment compact, low power requirements for the function accomplished, long product life, ready availability of printed circuit boards for advanced amateur gear, and not the least, a scientific desire to accomplish amateur missions with "state of the art" hardware. Perhaps one prime reason for advanced solid state amateur equipment rests in the very low cost of surplus IC's, transistors, and various special devices such as rectifiers, thyristors and other available solid state items coupled with their high degree of reliability—once the basic system is completed successfully. The use of integrated circuits, especially, permits the evolution of large sophisticated hardware systems, even approaching data processing systems in the commercial field. Some examples of such amateur systems now in operation are SSTV monitors, scan converters, fast to slow, slow to fast and a combination of both capabilities with additional frills such as frame-grab capability, automatic gray scale generation and image reversal. In addition, RTTY, micro-computer applications to amateur radio, auto-correlation methods for noise reduction and a host of addenda for the ham shack have evolved or are evolving directly as a result of the availability of surplus inexpensive solid state hardware items.

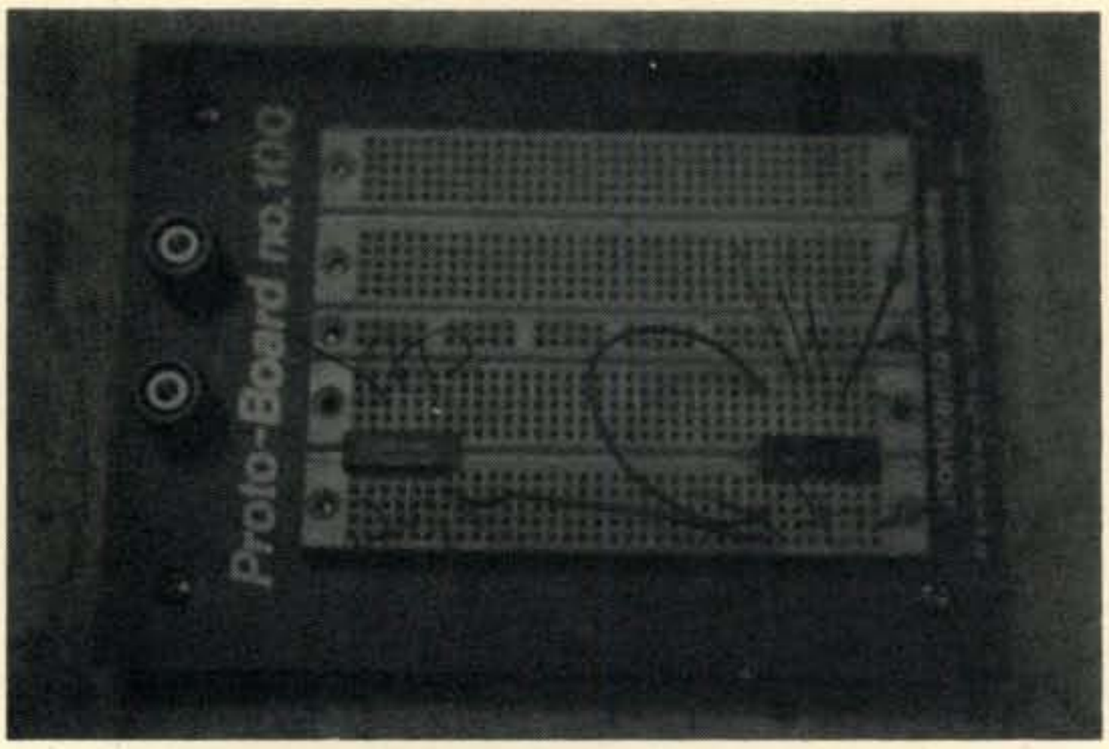


Fig. 1—Typical plug-in breadboard.

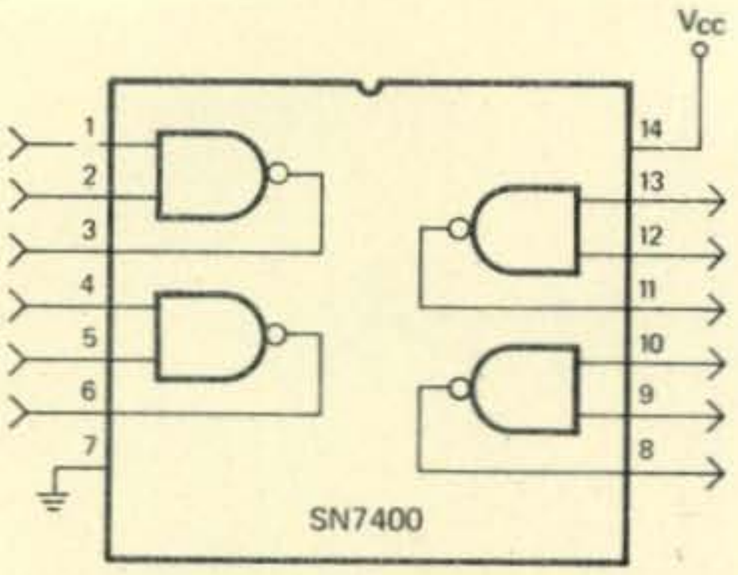


Fig. 2—The SN7400.

One of the big hurdles encountered in developing new advanced amateur gear and test equipment or measuring equipment is the attempt of amateurs to apply these surplus solid state items to designs without knowing for sure that the items are all working as they should. Many a project has come to grief simply because the hardware employed didn't work as specified in the manuals or specification sheets for such items, or perhaps the amateur designer didn't operate the solid state items well enough within specified tolerances. The obvious answer to this problem is to assure that all IC's, transistors and other such items are made to operate within acceptable limits. Devices such as transistors, rectifiers, diodes and single function solid state items are relatively easy to test for satisfactory operation, as are passive devices such as capacitors, resistors, inductors switches and like items, and the test of such items will not be discussed herein.

With regard to building hardware systems using solid state devices, rule number one should be to determine that every component is operable. As stated earlier, testing one function devices of a simple nature has been covered at length in the literature and test equipment for such items is inexpensive and easy to obtain. This is not the case for integrated circuit test equipment, and the new amateur systems are rapidly going in the direction of almost complete integrated circuit hardware. With many systems requiring literally hundreds of complex devices as exemplified by IC's, often complete failure of the system to "go" can depend on the operation of just one IC or solid state device. Thus it is imperative that the builder know at the very least that each one of the solid state devices operates within the specifications for which it is to be used. This leaves the builder two choices. He can either go to a solid state device outlet that is completely reliable (and that's asking a lot) or he can design methods to test the various components he intends to employ in his system. The first approach is expensive and still does not absolutely guarantee perfect hardware, thus the second approach is really the only viable method to assure satisfactory results. This second method has the added value that in addition to assuring the builder that each item of solid state hardware is operable, it can also be a good learning experience. It has the capability to show the builder all of the various capabilities of the IC items he tests himself in addition to the one use for which he may be testing the IC.

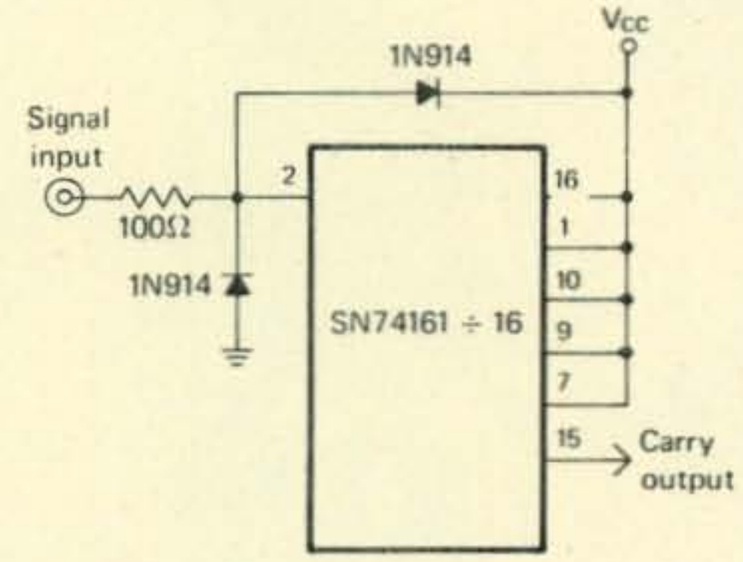


Fig. 3—Test circuit for ÷ 16 plug carry in a 74161.

This idea of IC testers and test devices for other complex pieces of solid state hardware generally stops most individuals in their tracks. For those brave enough to ask about the cost of IC test equipment, the answer from manufacturers is generally conclusively negative from a cost viewpoint. The point overlooked by those brave enough to ask about IC test equipment as an example, is that the quote they obtain from manufacturers of such gear is for test gear capable of testing IC's by the thousands and *not* one at a time. IC test equipment for testing one IC at a time hasn't been built by industry as it is not economically profitable to do so; however, a bit of further study by the enterprising amateur will show that almost any IC made can in fact be tested with a minimum of equipment, plus a little ingenuity. The best approach I have found to solving this problem of "does it work" involves a combination of test equipment and methodology, with less involvement with test equipment and more involvement with regard to "how to do it". The secret to testing any complex IC or similar device can be found in the specification sheet(s) for the device. Such data from the IC manufacturer often has included a method or circuit for testing the device.

Assure Component Reliability

With that introduction, the balance of this paper will be directed toward the use of specification sheets plus a limited amount of test equipment that the average amateur who enjoys building equipment has available or can obtain for a small sum of money. This assumes the possession of a v.o.m. (20,000 ohms/volt or better), a signal generator and small oscilloscope plus the usual small assembly tools. I recommend highly that any amateur who wishes to test his own IC's get one of the currently available IC circuit design plug-in boards[2]. The referenced type of plug in circuit board permits all of the wiring

and hardware for the experimental design circuits to be plugged into small sockets, so that a complete circuit for the test of a complex solid state circuit can be "hooked up" with nothing more than the components required, the IC or other piece of hardware to be tested, and interconnection wires. I have found that the ends cut from resistors and capacitors when mounting them on p. c. boards make almost ideal interconnecting wiring on plug-in test circuit boards. In addition, these ends from electronic components come in very handy as "jumpers" for one sided p. c. boards. Where longer wires or insulated wires are desirable, I find ordinary solid tinned hookup wire of between size 22 and 26 about right. Fig. 1 shows a typical test board for a rather simple IC with components and wires plugged into the board as required. A strip is provided on the board I happen to have for a power buss and is quite handy. Thus a simple five volt power supply and a volt meter is sufficient to test such an IC as a SN7400 as shown in fig. 2. A look at the spec sheet for a 7400 indicates that the output of each of the four NAND gates should be low (about ½ volts) when and only when both inputs to that gate are high (about 3½ to 4 volts), and if either gate input is grounded, the output should go to high as indicated by a voltage of about 3½ to 4 volts. Furthermore the output should remain at the high or 4 volt level as long as either input is held at ground potential. For example, in fig. 2, with power applied as shown, pin 3 should be high only when pins 1 and 2 are low. Thus with no more than a few clip leads, a five volt supply, a volt-meter and a base for mounting the 7400, each of the four gates may be tested statically in sequence for correct operation. If the static tests show that both a high or low output can be obtained from each gate when the correct inputs for the output are applied, it can be determined with a fair degree of certainty that the 7400 will operate satisfactorily within the speed ranges set in the specification sheet. It takes about 30 seconds to check a 7400 in this manner and that simple test can go a long way toward avoiding the agony of finding a bad 7400 in a large array of IC's. More sophisticated IC's may be tested, some even more simply, in a similar manner. Fig. 3 shows a means of connecting a 74161, taken from the specification sheet again, so that it can be readily checked out. This particular checkout is facilitated with the use of a simple oscilloscope and a signal generator. Even a sine-wave generator capable of delivering about five volts RMS output can be used to operate the counter. The two 1N914's and resistor are used to limit the input signal to a safe level for the 74161 and to assure that it does not exceed the recommended input voltage levels for the 7400 series TTL IC's. The 74161 can be tested rather completely by inserting a signal to the input indicated, which is the clock input for the 74161, and observing the output (carry output, pin 15). If a pulse is observed it is

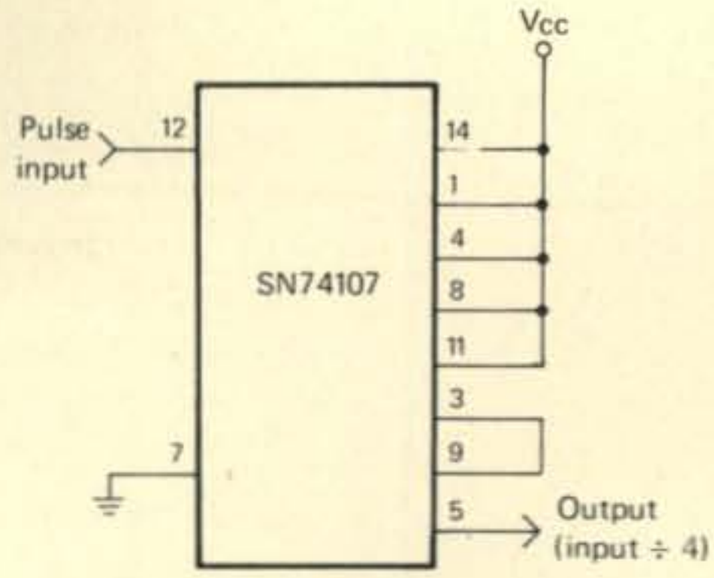


Fig. 4—A SN74107 divide by four counter.

established that the four flipflops in the device have operated correctly and provided a carry output. If it is possible with an oscilloscope, the carry count should be one sixteenth of the input counts. That assures that all counters are working within the 74161. For complete testing, each of the outputs, divide by two, four, eight and sixteen should be checked with the scope for outputs also. Generally only a check of the carry output will asure that the 74161 is operating as it should. It should be mentioned that once a test setup for an IC is made, all of the IC's on hand of the same type should be tested sequentially before rearranging the test circuit for another type of IC. It is well to add that the tests described herein only demonstrate that the IC being tested operate within the speed of the input pulses used and the voltage level employed. It is possible that an IC may pass these tests and not operate correctly if used at or near the upper limits of it's specified operation. The final test is in fact that the IC will perform the function desired in the circuit for which it is to be used. The elementary tests described herein generally will weed out the obviously bad IC's and go a very long way toward assuring successful system operation.

Much of the balance of this article will be devoted to representative test circuits for various IC's most often found in current published articles involving the assembly, debugging and operation of advanced electronics hardware from the average amateurs viewpoint[1]. A combination of different types of devices are frequently used in the above referenced

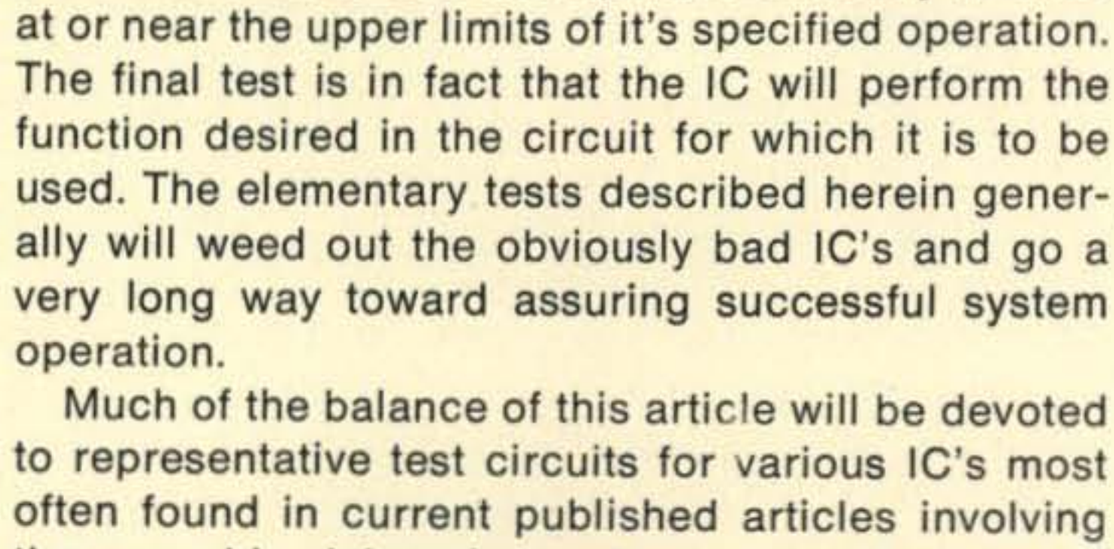


Fig. 5—A 2521 shift register test circuit used with the ÷ 4 circuit of fig. 4.

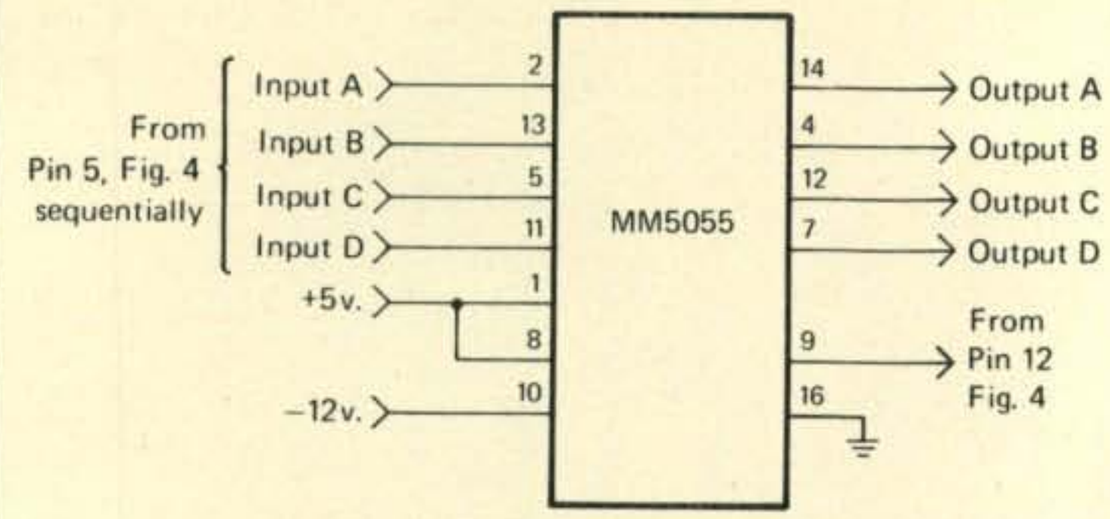


Fig. 6—A test circuit for MM 5055 s.r. used with the ÷ 4 circuit of fig. 4.

systems, the most common being the combination of compatible TTL and MOS IC's. MOS IC's require more sophisticated methods for testing than do TTL IC's generally, thus it is well to begin with TTL test circuits and show how those very circuits can be applied to testing the more complex MOS IC's. As an example of the build-up of test circuitry from one rather straight-forward circuit to a more complex one, and at the same time permit adequate tests for each of the IC's as they are added, consider the eventual dynamic testing of a MOS shift register by use of TTL flip flops. Fig. 4 shows such a beginning circuit in which a 74107 dual J K flip flop is connected to assure that it is operating and also dividing by four. This circuit then can be employed to provide the clock circuit and the dynamic data input for a MOS shift register. The input signal to the 74107, which is jumper wired as a divide by four flip flop from the specification sheet, can be employed as the clock driver for a 2521M, as in fig. 5, or a MM5055, as in fig. 6. Both of these devices are multi-channel 128 bit shift registers. The input signal to the 74107, or the divide by two output from the 74107 may be used as the clock driver for the 2521 or 5055 and the divide by four output from the 74107 then used as the data input to the various shift registers of the two MOS IC's and the outputs of each of the registers examined with an oscilloscope to determine that the alternate "1" 's and "0" 's are being cycled through the shift registers. In the case of the 2521 there are two registers in each IC and in the 5055 there are four parallel registers to be examined. It may be noted as an aside that in those cases where one of the parallel registers in a multi-register IC does not perform, that IC can be so marked and used in cases where all of the parallel registers are not required. I do not recommend this practice although the subject registers are rather expensive and one may exchange shift registers at a later date and run into trouble with the inoperable register. A further test of the MOS IC's which is very useful is to vary the negative voltage input from it's assigned value of —12 volts to a lesser value and observe when the MOS device begins to become erratic in performance. Often it will be observed that some MOS devices will operate only at the specified voltage levels, while others may operate at much lower levels. In the case of dynamic shift registers such as 1404's, the less the negative drive voltage they require (clock drive) the less power they dissipate. This becomes important when such devices are run at or near their upper limit of operation, as many MOS units will be found to be heat sensitive and begin to operate erratically or even fail if drive voltages are too high. MOS devices have been encountered by the author which operate only at unspecified voltage levels. Needless to say, such devices should not be employed in IC systems. There are cases[3] where the author of an article will specify a voltage level different from that specified in the literature for an IC. It is noted that the author may have good reason for such deviation, such as low power operation of the MOS devices used to reduce heating. Generally, such changes in voltage levels to the IC's will be accompanied by reduced frequency requirements or some other parameter that permits the reduction of power to the IC. In some cases it is found that an IC does not operate as the author states with the voltage levels specified, and the IC(s) is known to be good, a note to the author may well be in order to clarify the problem.

A word as to basic needs for testing TTL and MOS IC's is in order. I strongly recommend to the amateur who is dedicated to building his own solid state equipment that he either build or buy a small laboratory power supply having outputs of plus and minus five volts and twelve volts. In addition, one variable voltage output can be very valuable in testing IC's. Regulated power supplies of such a nature are elementary to construct with the new three terminal regulators available and numerous circuits in almost any reference book. For the amateur unfamiliar with such regulators, check the LM309K, LM320 series and LM340 series. There are readily obtainable from electronic surplus suppliers at very low cost and along with a power transformer, rectifier network and filter capacitors, can provide voltage levels of plus or minus 5, 12, 15 and 24 volts at up to an ampere of current or better. With regard to the use of power supplies in testing IC's, I have found it

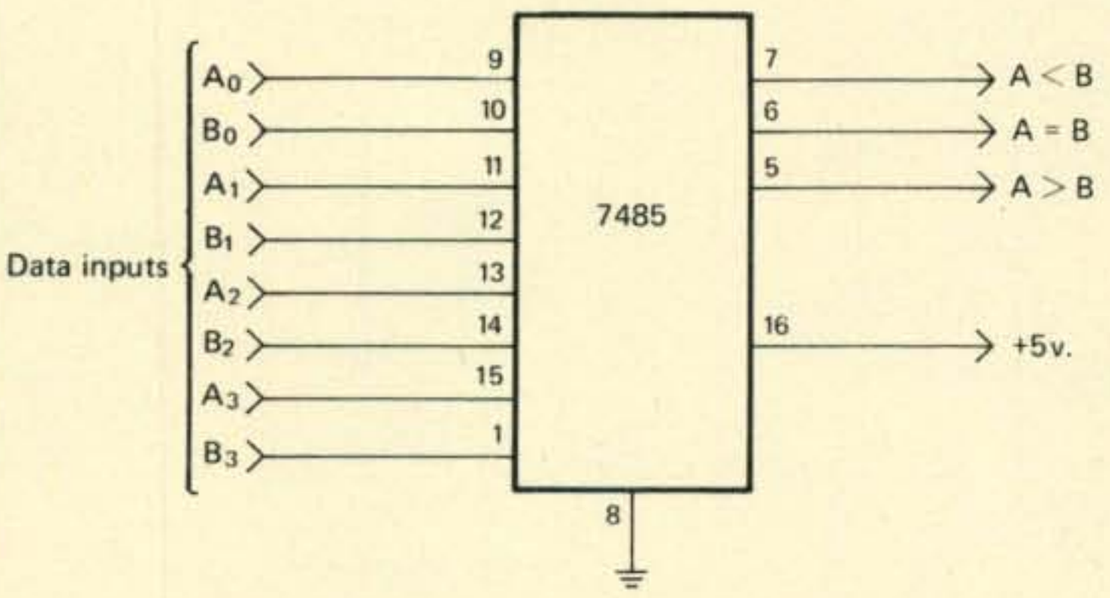


Fig. 7—The SN7485 4 bit magnitude comparitor.

costly not to double check the power connections to the IC test circuit I am using. Generally, a wrong voltage too high or negative rather than positive on an IC under test means an IC for the waste basket.

To continue with examples of IC's that appear difficult to check, but in fact are not if the right methods are used, fig. 7 shows a means for checking a 7485 which compares four binary bits from one source with four such bits from a second source and will indicate whether the two sources provided an identical binary signal, one greater than the other or vice versa. As can be seen from fig. 7, all that is really required is a single power supply, some jumper wires and checking the correct output terminals when the input terminals are connected as stated in the truth table[4] of the specification sheet. With regard to the 7485 and it's spec sheet, if A_3 B_3, pin five is high and six and seven are low. If all A's and B's are equal pin six is high and pins five and seven are low. The spec sheet has all possibilities for comparing four binary bits with a second set of four binary bits. Further two sets of eight binary bits may be compared for A B, A=B and A B by using two 7485's and larger sets compared by cascading 7485's as shown in the spec sheets. In a like manner a 74157 multiplexer can readily be tested as shown in fig. 8. Either static testing or dynamic testing may be performed. Generally a static test, which does not require an oscilloscope or counter, indicates that the device will perform satisfactorily dynamically. Referring to fig. 8, when pin 1 of the 74157 is grounded a low signal on the four A inputs would result in a low signal on the output terminals corresponding to the four input terminals. In like manner a high signal in the four A input terminals will result in a high output on their corresponding output terminals. When pin 1 in connected to plus five volts, or in the high position, signal inputs to the A terminals should have no effect on the output terminals, but the four B input signals should be faithfully registered on the output terminals just as one would expect with a four pole double throw switch, which in fact is what the 74157 represents electronically. As an additional example consider the 7430 eight input NAND gate. In order for a low output to occur, all eight input terminals must be held in the high position. (Caution, TTL IC gates may give apparently wrong outputs if any of the unused input gates are left unconnected. As in the case of the 7430, if a five input gate were required, it is advisable to connect the three unused gates to the plus five volt level through a resistor to assure that they are held in the high state). Thus in the case of the 7430, if any one gate input is brought to the low level (ground) the output should go to the high level. If all of the input terminals are not connected to either ground or plus five volts, it is very probable that the output will go to the low level as long as no input is grounded. Unused or unneeded extra inputs to TTL gates are often left "floating" with no bad effect, but the procedure is not recommended by the manufacturers and should be avoided, even if published circuits do not provide such returns for unused inputs. A recommended rule of thumb is to tie all unused gate inputs back to plus five volts through a 1000 ohm resistor. As stated in almost all specification sheets it is very unwise to exceed the maximum voltages recommended for use with IC's, but in testing them it is a good practice to operate the IC's at a reduced volt age if convenient and observe if they perform correctly, especially if being tested dynamically. When testing TTL IC's at reduced V_{cc} it is well to be certain that unused input terminals are tied back to the reduced V_{cc} and not to plus five volts or the normal specified V_{cc}.

MOS devices can be readily checked as indicated in the previous examples, however, there are different types of such devices and care should be taken that specified instructions are followed. Many MOS devices in use currently require complex clock

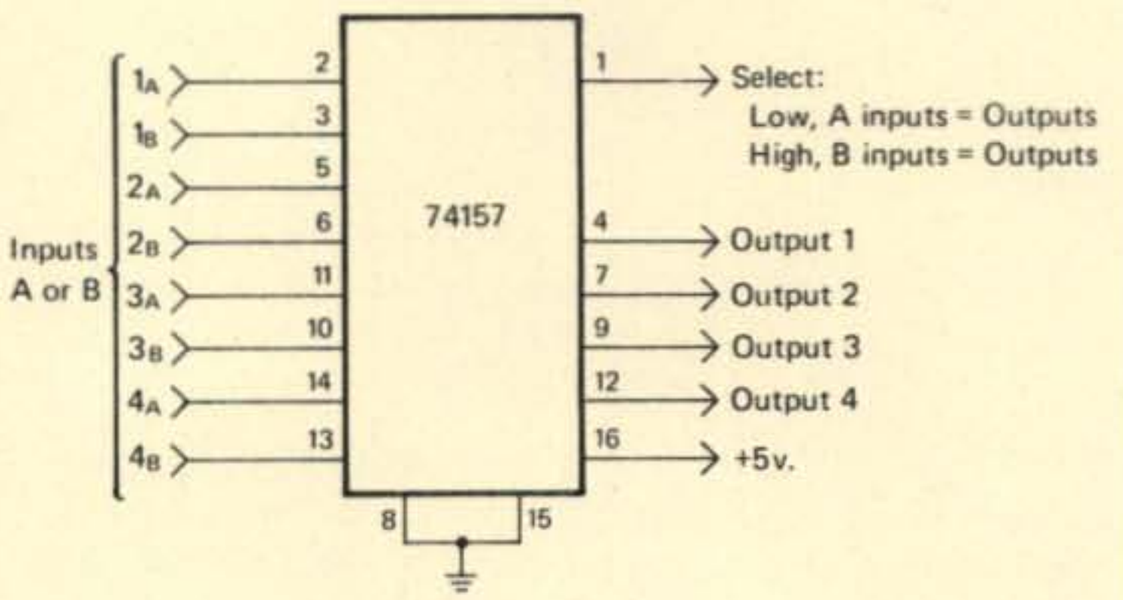
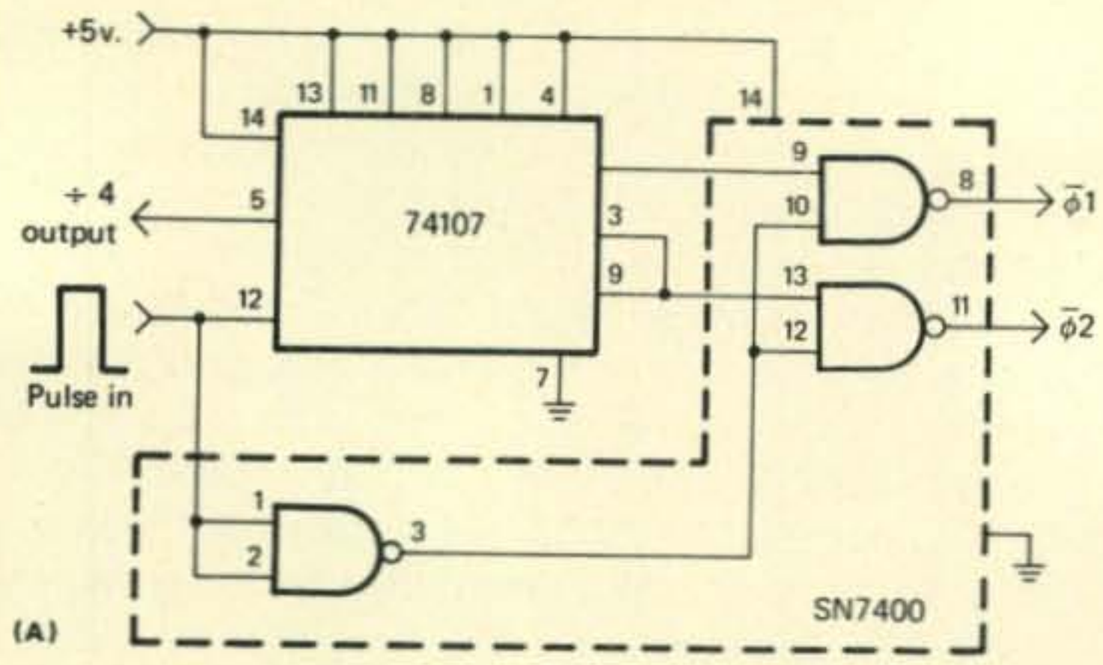
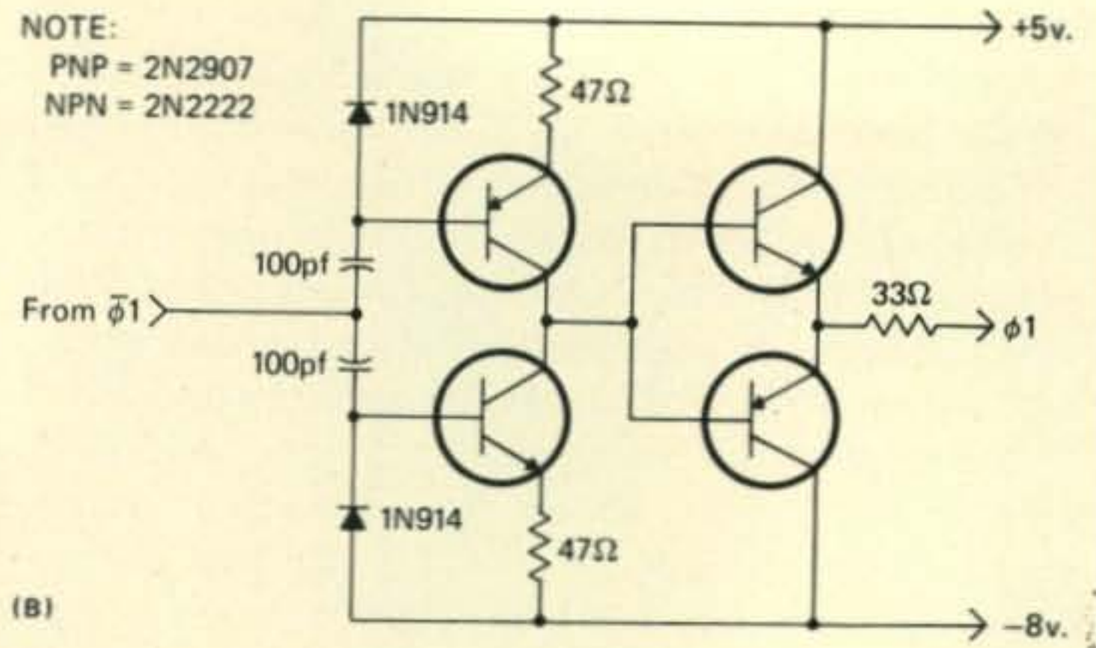


Fig. 8—The SN74157 test circuit.

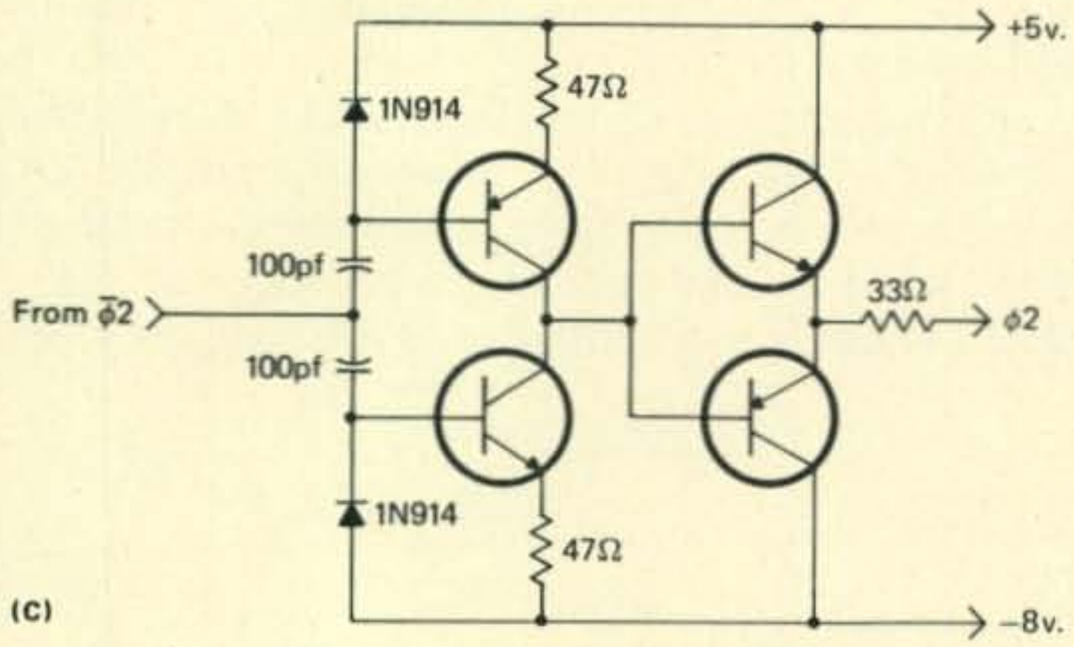
drive systems. As an example the 1402, 1403, 1404, 2502, 2503 and 2504 families of dynamic shift registers require a two phase clock. Other MOS devices require three and higher phase clocks. In order to test such registers the correct clock system must first be assembled. We will devote attention to the two-phase clock primarily since most of the multiphase clocked MOS IC's of interest to amateurs currently use only two-phase drivers. As with building up test assemblies for TTL/MOS combinations discussed before, the two-phase clock system drivers can easily be assembled from relatively simple TTL hardware and transistors or a combination of TTL hardware and special two phase clock drivers for MOS drive applications. One such clock driver is shown in fig. 9. If desired a MH0026CN or similar two-phase clock driver can be used in place of the transistor/R/C network.[5] The two phase clock driver shown in fig. 9 can be constructed from TTL IC's and ordinary transistors, diodes and passive components. If it is desired to employ two-phase clock drivers such as the MH0026C family, fig. 9 (a) shows



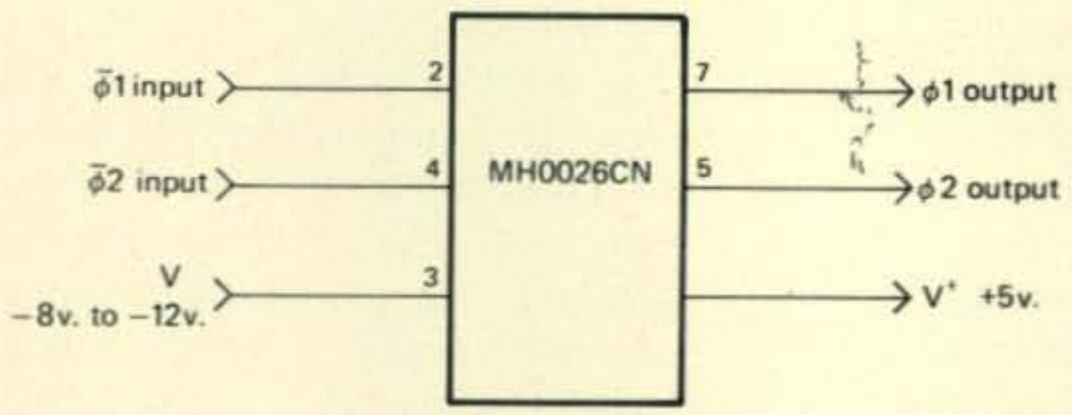
(A)



(B)



(C)



(D)

Fig. 9—Two phase clock driver for 1404, 2504 and other MOS shift registers requiring and two phase clock drive.

(D) Test circuit for MH0026CN Used with 74107, 7400 portion of fig. 9.

how to replace the transistor network with the clock driver. Once the two-phase clock driver assembly has been constructed and used to test the IC's employed in it, the assembly is ready to now test the families of shift registers listed above including the 1404. Fig. 10 shows how to connect the clock driver to the 1404 and a data signal derived from the 74107 of fig. 9. The shift register can then be tested dynamically with the use of a pulse source and an oscilloscope to observe the output of the shift register.

The above examples are a small sample of the vast number of simple test setups that can be quickly assembled using one of the currently available plug in boards, or a home built vector board array. It is hoped that the above examples demonstrate that the business of testing IC's is not the problem many think and it is most assuring to be certain that all of the IC's used in a large solid state system are in operating order when system debugging begins. I have had the experience that the big problem involved in making a system "go" only begins when the hardware assembly phase is finished, unless it is a well proved and debugged system such as kits sold by the Heath Co. or other well known kit suppliers. The preceeding information is not aimed at making such proved systems operate but those that are new state of the art systems as listed in the bibliography, for which there are no "in case of trouble" sections written.

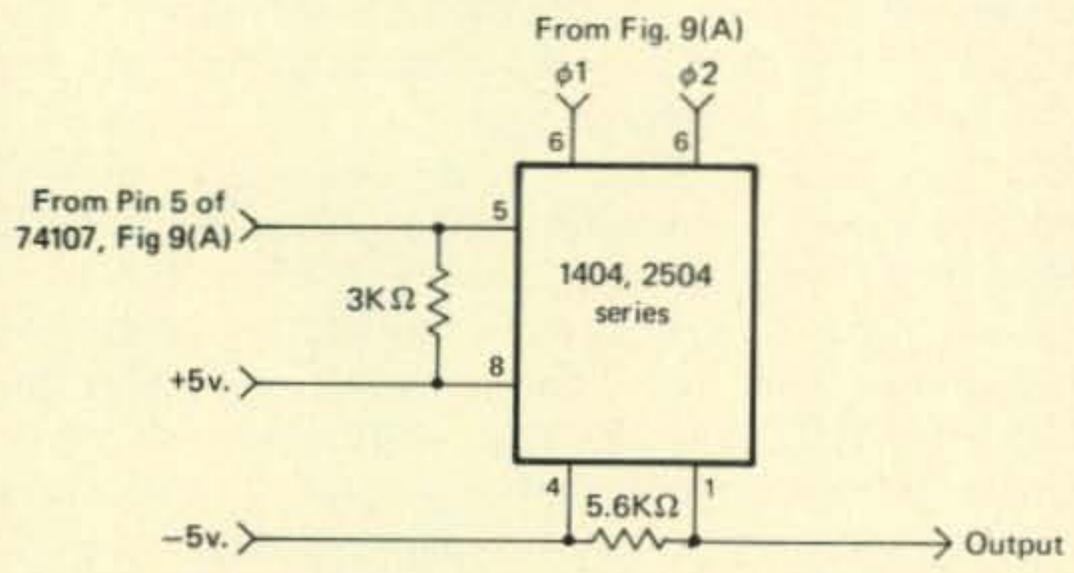


Fig. 10—Test circuit for dynamic MOS shift registers 1404, 2504, etc.

Possible Printed Errors

Having assured oneself that the hardware to be employed in a new solid state system is good is the first step toward attaining that goal of having a working system. As stated earlier, there is much between having working parts and making them work as one wishes. To repeat, it is well to be suspicious of everything! Large IC systems cost a great deal of money and time and care must be taken at each of the several steps in realizing such hardware systems. If one is handwiring a device from a schematic in one of the amateur radio magazines it is recommended that

(continued on page 68)

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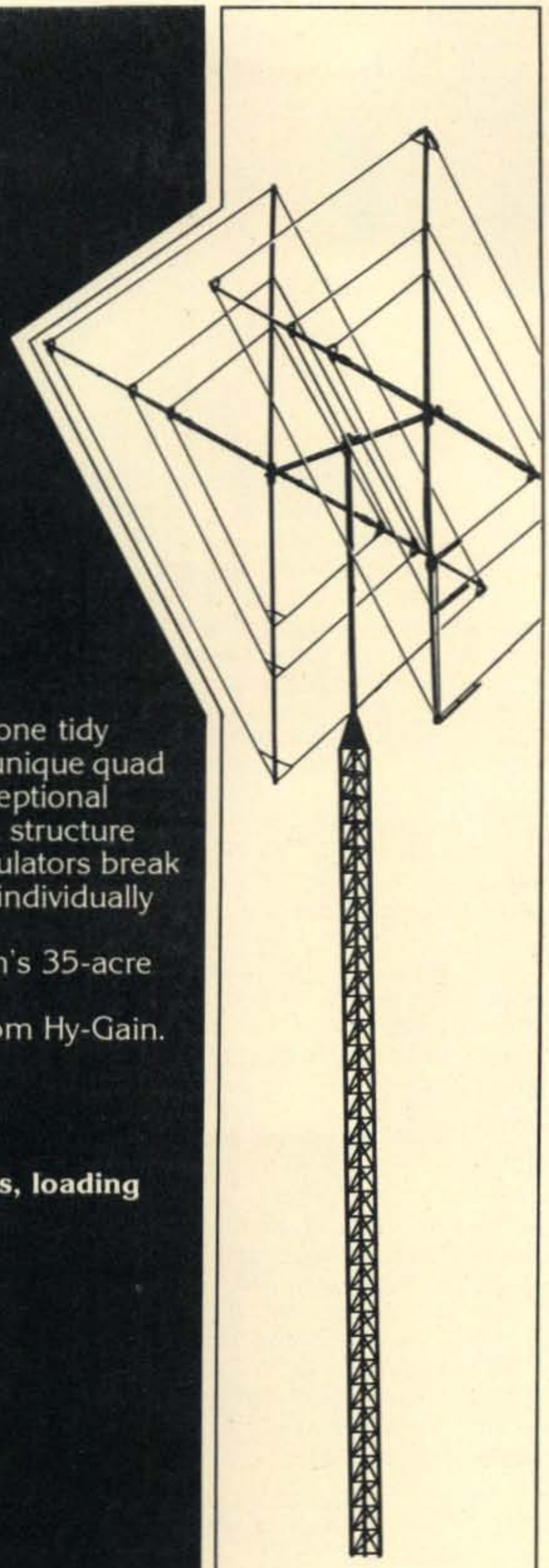

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ADRIAN WEISS, K8EEG, ON

QRP

Being a "wandering scholar" does have its drawbacks when it comes to enjoying amateur radio operation. It seems that everytime I get a decent antenna up, I've got to pull it down and move elsewhere. This time, I thought, I'd beat the problem by getting one of those miniaturized beams that can be broken down into a six foot box for easy transportation, and then easily erected at a new QTH. All the oldtimers warned me that such an antenna couldn't do the job of a full-sized one, but I paid them no heed. Woe was me as a result. After about 15 hours tuning the miniature yagi for a decent f/b ratio and some forward gain, both field strength measurements and S-meter reports over thousand mile paths confirmed the wisdom of the oldtimers. The miniature beam was 2db *below* a reference dipole. Imagine, then, gentle reader, in what frustration and despair the following antenna was conceived.

Taking survey of available materials that were at my disposal, the following criteria emerged as project goals for the antenna: it had to be cheap, easy to toss together, easy to tune, durable enough to take South Dakota winter gales, light enough to turn with a standard TV antenna rotor, and provide good gain and f/b ratio. The antenna that was born in desperation has turned out to be a joy indeed when fed with my puny 700 milliwatt signal. Read on.

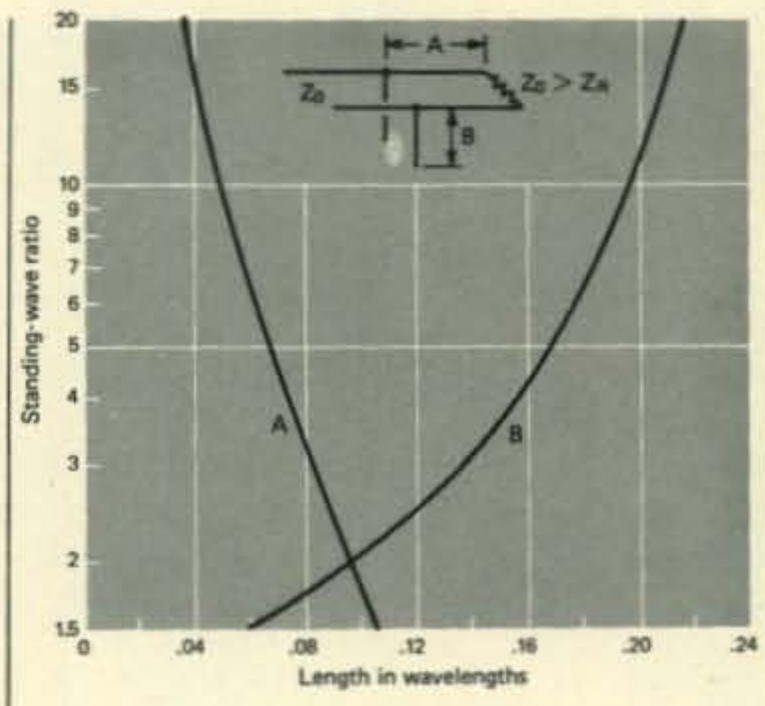


Fig. 1 — Comparitive graph of element position and length of the open stub as a function of s.w.r.

Design Theory

A bit of research into the antenna handbooks led to the conclusion that a close-spaced two element yagi with parasitic element tuned as a director would allow for maximum performance. The decision to use the parasitic element as a director—in contrast to current practice of using it as a reflector—stemmed from several factors. First, the relationship of element spacing, attainable f/b ratio, and feedpoint to the physical sizes of the corresponding types of tuning suggested the use of a director. Optimum spacing for a two element yagi using a director is about 0.1 wavelength it is about 0.16 wavelength for a reflector. In practical terms, this comes out to approximately 6.5 feet and 10 feet, respectively. The torque resulting from wind-loading is easily twice the amount for the 10 foot spacing as for the 6 foot spacing — an important consideration when contemplating the use of a standard TV rotor. Secondly, the director case has some advantage in terms of attainable f/b ratio. With the closer spacing, there is greater interaction between driven and parasitic element and this results in greater cancelation off the back of the antenna. This also results in higher-Q which in practice can mean a decrease in the effective bandwidth over which the close-spaced yagi will allow a match below a certain specific s.w.r. This had me worried a bit, but the finished product, with open stub matching to the feedline, exhibits less than 1.5:1 s.w.r. over the entire band. Thirdly, the input resistance of such an array is in the neighborhood of 30 ohms, a not unreasonable match to 50 ohm line. And finally, since we are dealing with a full-sized yagi, design and construction is straight forward with no tricks needed.

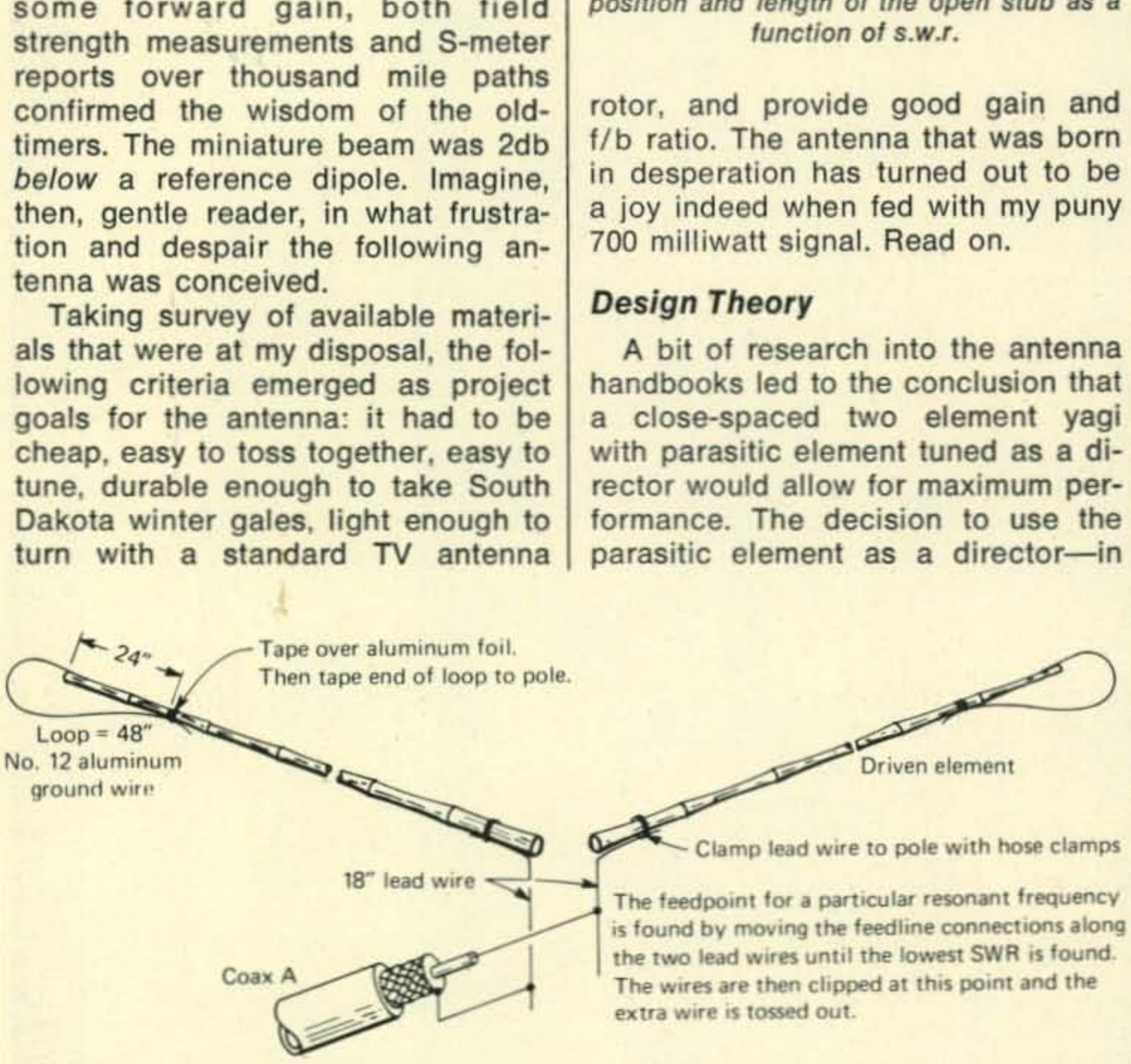


Fig. 2—Mechanical details for the economical 14 MHz two element yagi. The director tuning is done the same with a shorting bar that is moved up and down until the greatest f/b ratio is achieved.

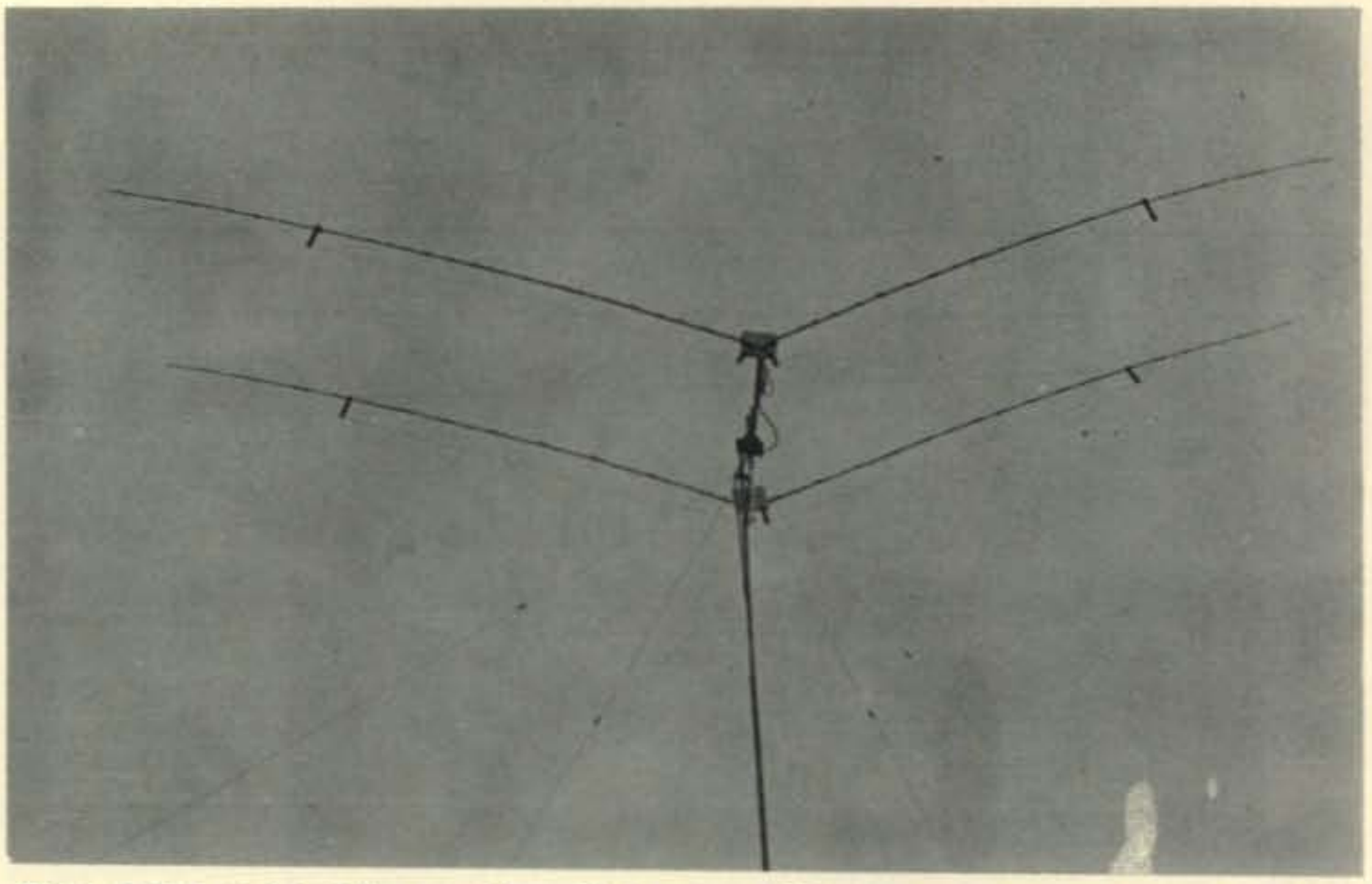
Construction Approach

The next problem was arriving at a physical form of construction that would allow us to reach our cost, weight, and durability requirements. Aluminum tubing was out of the question because of price; weightwise, it seemed acceptable. But it simply wasn't available hereabouts. I

discovered that the local hardware store carried bamboo poles for 82¢ each, and this seemed to offer some promise. The original idea was to use bamboo poles to support wire elements, but after more research, this appeared undesireable, since the effectiveness of a yagi is related in part to the diameter of its elements. An old trick occurred to me at this point. Some years back, I had used a bamboo pole wrapped with aluminum foil as a ground-plane element—after two years in the sky, the pole was remarkably well-preserved. I decided to try this approach. So far, the antenna cost me $5.28 for the poles and four boxes of cut-rate 25 ft. aluminum foil, 12 inches wide. Next, the question of the actual physical configuration was tackled. There was something unwholesome about the way the bamboo poles acted in a wind when held horizontally. It seemed that the only way to simply hold the elements in their respective planes was to mount them in a wide-angle upright "V" with a piece of nylon string strung from the ends of the elements to form a triangle. The logical way of mounting the elements was ¾ inch exterior plywood, which is much stronger than pine or other cheap woods. This could be easily done with pipe strap brackets clamping the elements to the plywood templates. After a couple of false starts, we struck upon the right method of attaching elements and templates to the boom, which was cut from an old TV mast laying around here. Four ninety-degree angle brackets could be bolted first to the boom, and then screwed to the element templates. A plywood template similarly could be used to attach the boom to the mounting mast.

Assembly

The actual time to put this all together was about five hours, not counting false starts. When purchasing the bamboo poles, the correct way to evaluate a pole is to check the diameter of its small end — the larger the better. If you can get 18 ft. poles, use two for the driven element instead of a 16 footer with wire loading loops at the ends. Assembly follows this procedure. Varnish each of the bamboo poles with a heavy coat of exterior varnish—paint could be used also. By the time the fourth pole is done, the first pole will have dried to a "tacky" consistency. Roll out one of the 25 ft. boxes of aluminum foil on a sidewalk or other flat surface, cut it at the proper length, and lay a pole along its edge.



When it was up I had the most beautiful antenna I'd ever seen winging its way to DX.

Next, press the edge of the foil to the pole from one end to the other, and then simply roll the foil onto the pole. Then, beginning from the large end of the pole, twist-tighten the foil in the same direction as it is wound; leave about 6 inches of foil loose on each end so that the end loop of the driven element and the 18 inch feedline connecting wires can be inserted between two layers of foil. Insert the feedline wires and loops, twist-tighten the foil and clamp tightly with regular hose clamps. At the outer ends of the driven element, insert one end of a 48 inch piece of aluminum guy-wire, tape securely, and loop back 24 inches. Wrap the tin foil with tape for insulation, and then tape the end of the loop wire to the pole at that point. The elements are completed by wrapping plastic tape helically the entire length of the pole, with a pitch of about one turn per foot. This tape will keep the foil from peeling back during high winds. The completed elements are then mounted on the plywood templates with pipe straps, as shown in the photo. Use 1" × #10 woodscrews to hold the pipe straps in place, and make sure that the pole is held very firmly to the template. The elements are ready to mount on the boom.

To prepare the boom, cut it to the right length (6 foot in my case) and clamp four ninety-degree brackets to each end of the boom using standard muffler clamps (1½ inch dia. in the case of the typical TV mast used for the boom). After very carefully lining up the angle brackets with the edges of the boom, drill through the holes in the brackets, through the boom, and out the holes in the bracket on the opposite side of the boom. Then insert ¼ inch bolts and secure firmly. Tighten the muffler clamp all the way. Next, cut out the plywood template for mounting the boom to the mast, and pipe strap it to the boom with #10 woodscrews. Do the same for the mast. In order to avoid rotation of the mast relative to the antenna, drill a hole through the mast and template, and insert another 3 inch ¼ inch bolt and secure (once the antenna is complete and the elements are aligned with respect to horizontal, a similar hole is drilled through the boom and template, and bolted).

The yagi is ready for attachment of the elements to the boom. A suggestion here. With the element laying on the ground, place the boom on the template and use 1×12 woodscrews to secure the angle brackets to the template; before attaching the director element to the boom, resonate the driven element at about 13050 kHz (for a later resonance at about 14100 kHz). This can be done by hooking up the driven element to

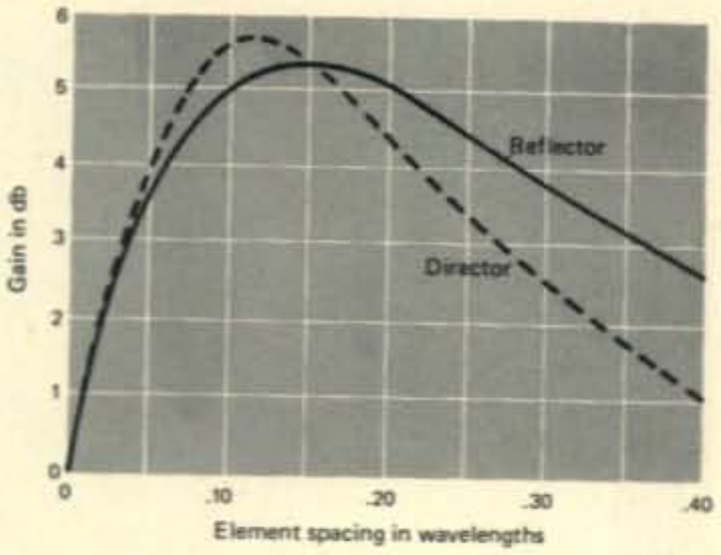
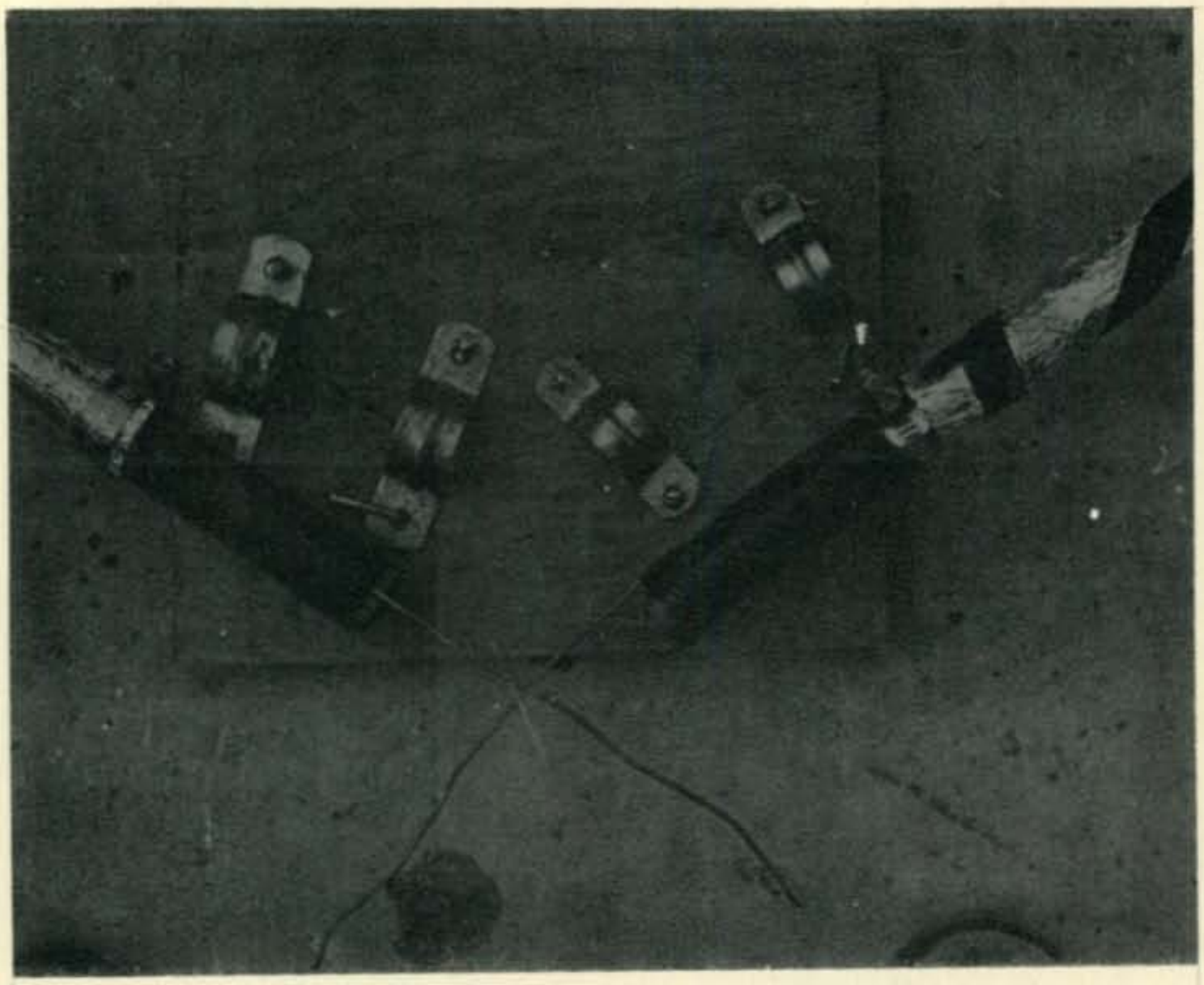


Fig. 3—The optimum theoretical gain of a parasitic element over a half-wave antenna. This assumes no inherent losses.

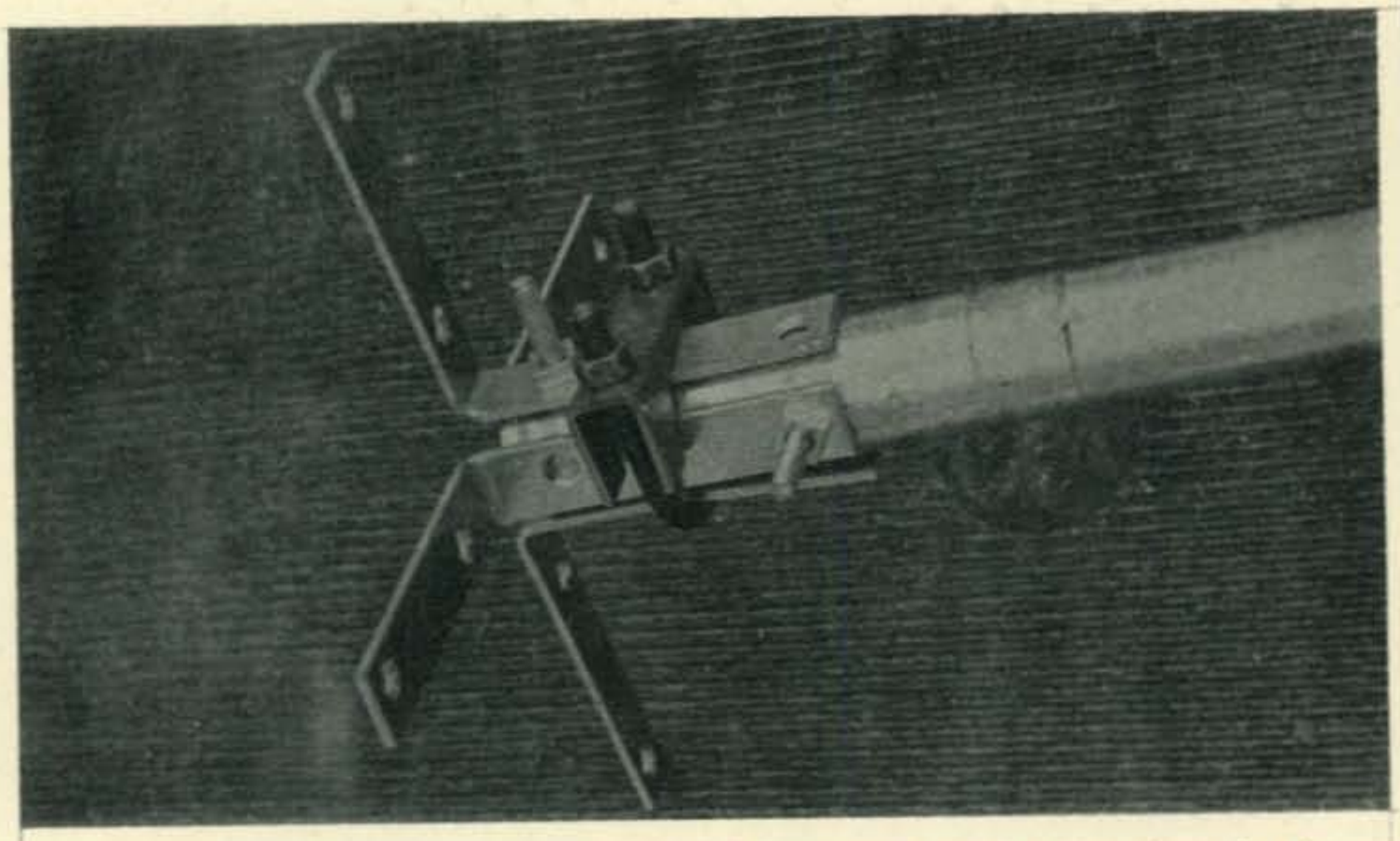


The template for the element mounts and the pipe straps used to screw the elements to the template. The wire leads are taped to the ends of the elements and secured firmly with hose clamps.

the transmitter, and tuning for a low s.w.r. at the low end of the band. The resonant frequency of the driven element is varied by moving the feedline along the feedline wires until the proper position is reached. Then the other element can be mounted on the boom in the same way. I mounted my director element with the rest of the antenna mounted on the mast, but this procedure can be done by having someone hold the driven element up while the boom is placed upon the director element as it lays on the ground. In any event, take care to align the elements so that they share the same planes. Once the director is attached to the boom, the beam can be tuned.

Tuning

Two methods are viable for tuning the beam. First, you can mount a field strength meter a couple of wavelengths from the antenna, and hook the transmitter to the antenna. A pickup antenna for the field strength meter should be sufficient to give full scale reading on the meter. It is best to tune for maximum f/b ratio, so point the beam in the direction opposite the field strength meter. Then the sliding short on the director wire leads is moved back and forth until the field strength meter gives the lowest reading off the back of the beam. Once this point is found, you can swing the beam around and see if you get a great increase in field strength reading. You should. The other approach is to tune the antenna in its receiving capacity (law of reciprocality here—it does the same on receive as on transmit). In this case, the transmitter feeds an antenna a couple of wavelengths away from the yagi, and the field strength meter is coupled to the driven element (feedline should be connected to the antenna, but unterminated at other end). Again the director tuning lead short is adjusted for minimum signal off the back end of the yagi. And that's it—it's tuned up. The actual adjustment should take about ten minutes.



Close-up of the mounting brackets and the boom end. The muffler clamp is shown in place.

Matching

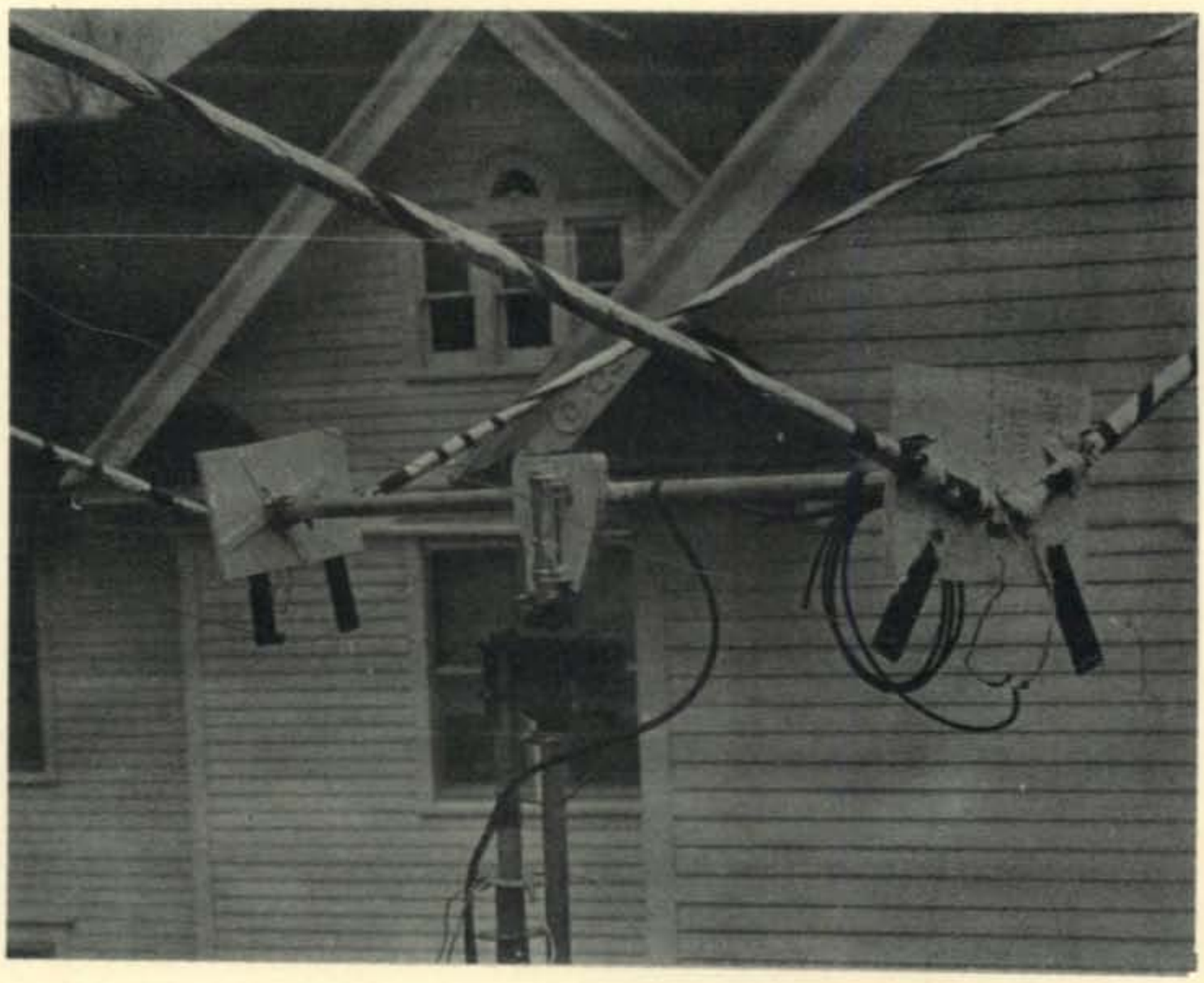
After this procedure has been completed, hook the transmitter to the antenna through a quarter wave *electrical length* (44.5 ft.—one wavelength approximately for RG-58U and RG-8U) and load up. You will notice that the s.w.r. is somewhere around 2:1 to 3:1. This is normal because of the interaction of the driven and director elements. Don't attempt to "touch up" the driven element for lower s.w.r.—it isn't the cause of it. Explanation: when you tuned the driven element for resonance without the director in place, the input resistance of the driven element (actually a half-wave dipole) presented a close match to the 52 ohm coax, hence the low s.w.r. at resonance. When the director was mounted and tuned, however, the input resistance dropped by as much as one-half and perhaps more. What we have then is a problem involving the mismatch between the input resistance of the driven element and the impedance of the coax. We can solve this problem with an open line matching stub. Some antenna basics in this respect. In order to achieve an efficient transfer of power from feedline to antenna, the ideal case is one in which the impedance of the coax equals that of the antenna input resistance: hence, a 50 ohm input resistance fed with 52 ohm coax will exhibit a 1:1 s.w.r. anywhere along the coax feedline. However, when the input resistance and coax impedance are considerably different, a "mismatch" occurs that makes the feedline behave differently. Looking at the feedline from the transmitter

end, the resistive impedance of the antenna will be "seen" by the transmitter at points one-half electrical wavelength, and multiples thereof, from the antenna. At all other points on the feedline, a different impedance will be "seen" consisting of a resistive component and a reactive component. What this means, then, is that if we can find a place on the half-wave feedline at which the resistive component is the same as our feedline, say 52 ohms, we can insert our 52 ohm feedline at that point and a proper resistive match will result. But we also have to take care of the reactive component present at that point in the feedline. To take care of this reactive component, we simply shunt the feedline with a reactance of the opposite sign—capacitive, or open end stub line, inductive, or short-ended stub line. What results, then, is a matched feedline which has no standing waves along its length, regardless of length.[1] That is the principle of the matching stub that is used here. Fortunately, there is no need to fool with complex formulas in practice: since the mismatch relates directly to s.w.r., we simply measure the s.w.r. at the transmitter end of a half wavelength feedline, and then refer to Chart I for the proper *electrical* length of matching line and stub line. For final adjustment of the match, however, the s.w.r. bridge should be inserted right at the insertion point in the match-stub line. So, when you cut the match-stub line from Chart I, leave a couple inches extra for final pruning at the antenna. Simply feed the antenna through the experimental match-stub line, and cut-off or add on pieces of coax until the s.w.r. between feedline and matching point is as close to 1:1 as possible. The s.w.r. should be 1:1 down in the shack too after this adjustment. In my case, the antenna is fed with about 100 feet of RG-8U, and the match-stub lines came out to A = 52" and B = 70 inches, see fig. 2. The antenna is ready to hoist into the wild blue yonder for its DX-chasing.

The antenna described here achieves all design objectives, and appears to approach the theoretical gain and f/b ratio given by antenna handbooks for a two element yagi. Conservatively rated, the f/b ratio is 15db, with about 25db cancellation

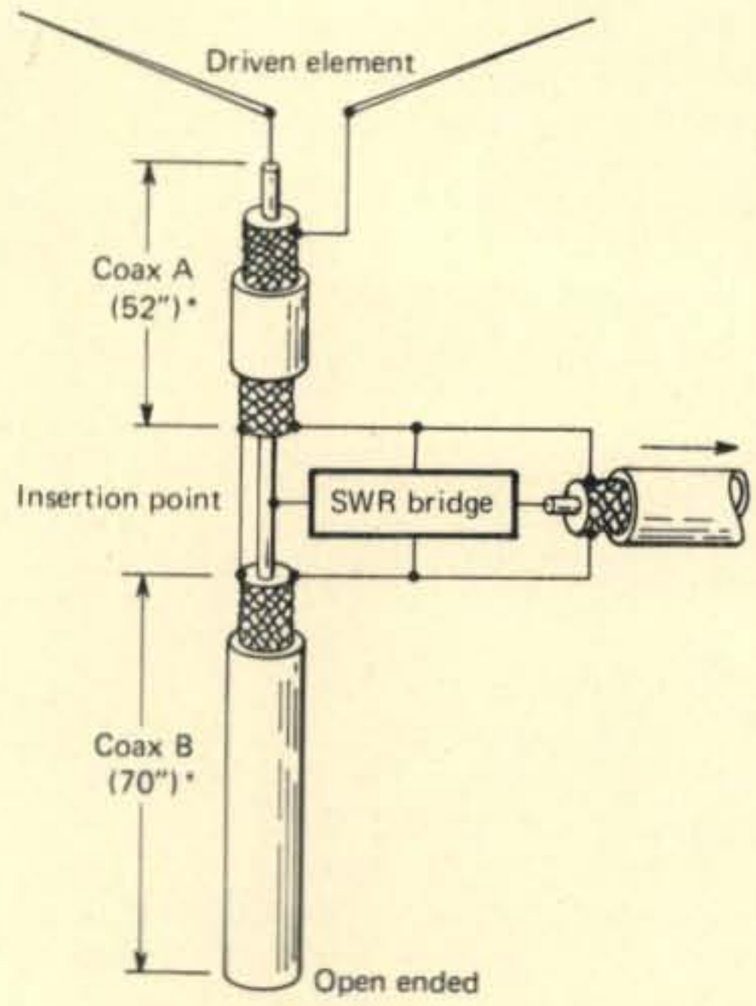
(Continued on page 71)

[1] *R. H. Fransen VE6TW, "Antenna Theory in Practice," CQ, Vol XXIV-#9 (September, 1968), pp. 67-71).*



Details of the boom assembly on the completed antenna.

Fig. 4—Antenna stub set-up and tuning procedure. See fig. 1 for proper A and B lengths relating to the s.w.r. that you measure either at the antenna or back in the shack through a multiple B of ½ electrical wavelength of coax. The dimensions A and B shown are my dimensions for my antenna and feedline. The final tuning set-up is shown with the s.w.r. bridge between the feedline (any length) and feedpoint; after the s.w.r. is down to 1:1 nominally, remove the bridge and connect the feedline at the insertion point. A coax "T" connector could be used at the junction of coax B but it is easier to solder the feedline directly to the stubs. Use the same feedline coax for matching stub for the main feedline.



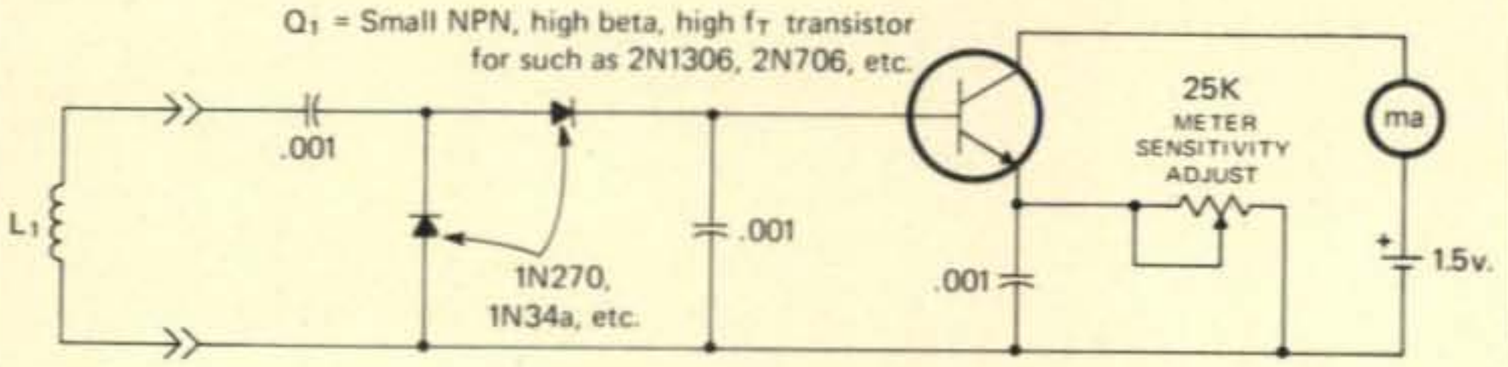


Fig. 5—A sensitive field strength meter. L1 can be anything from a single loop to at most several turns loosely wound around the driven element feedlin connecting wires sufficient to give an adequate meter deflector. The feedline should be connected at the feedpoint and unterminated at the far end (just left unconnected). This cicircuit was developed by W4EZW and published in The Milliwatt, August 1971, p. 4.

Math's Notes

BY IRWIN MATH, WA2NDM

Last month we discussed converting basic moving-coil meter movements to voltmeters, ammeters, and milliameters for use in various applications in home construction. At that time however, we only covered d.c. considerations. This month, we continue the discussion with a.c. reading instruments and conclude with special applications of panel meters.

A.C. Voltmeters

The most common way to convert a d.c. type movement to a.c. is by simply adding a suitable bridge rectifier in series with the multiplier resistor and across the movement as discussed last month. Fig. 1 shows this hookup. The bridge rectifies the incoming a.c. and converts it to pulsating d.c. and the meter indicates the average value of the d.c. flowing through it.

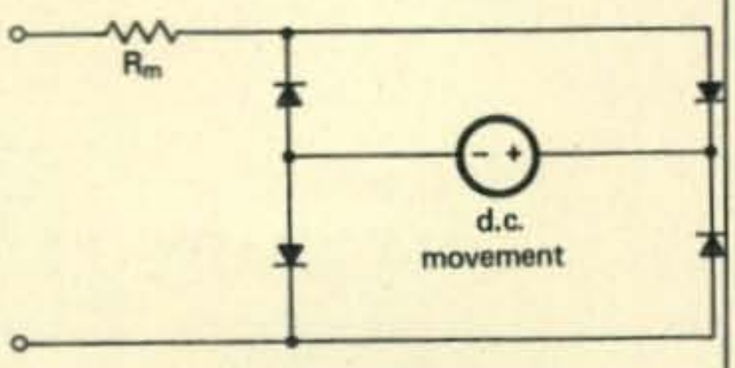


Fig. 1—Basic a.c. voltmeter circuit.

There are three very important properties of this type of circuit that must be considered. One is that such a meter indicates the *average* value of an a.c. wave form and not the r.m.s. (or equivalent d.c.) value. One *can* calibrate this type of meter in r.m.s. voltage however, and it will be accurate *as long as the wave shape doesn't change.* In other words, calibrate it by means of a sine-wave voltage and use it only to measure sine-wave voltages, not such non-sinusoidal sources as the output of SCR's TRIAC's, etc.

The second consideration is that

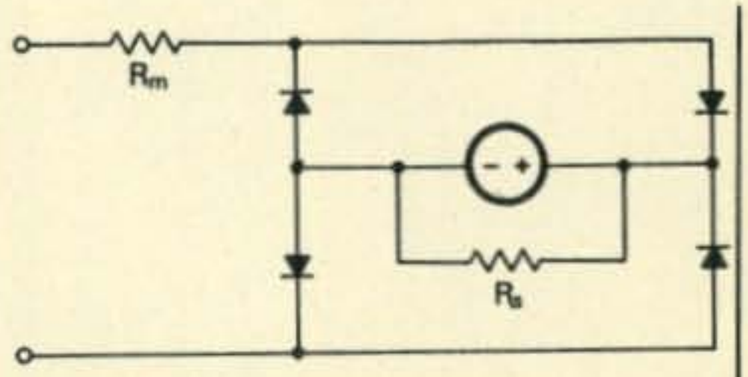


Fig. 2—Basic a.c. voltmeter with improved linearity.

solid state diodes are not perfect rectifiers and exhibit a non-linearity when very small currents flow through them. This will usually result in a non-linear meter scale. One way to minimize this problem is to shunt the meter with a resistor to increase the current flow to a point sufficiently beyond the non-linear point to minimize this effect. Fig. 2 shows a properly shunted circuit. A typical minimum full scale desirable current for such a basic movement is ½ milliampere.

Once the meter is shunted, the value of the dropping resistor, R_m, is of course now dependent on the new total current necessary for full scale deflection.

The final consideration is temperature. Diodes are temperature sensitive and the entire meter will only remain reasonably accurate if it is kept within a few degrees of the calibrating temperature. When used over a wide temperature range, steps must be taken to somehow isolate the meter from this variation.

In the interest of economy and simplicity in regard to a.c. voltmeter calculations, let us refer to fig. 3. This is a simple, a.c. meter circuit that can be easily customized by a user and one that employs the same 0-50 μA, 1000 ohm meter movement we used in our examples last month. Alternately, d.c. movements of up to 200 microamperes or so can be used.

In this circuit D_1 rectifies the incoming positive half cycles and applies them to the meter. The other diode, D_2, shunts the undesired negative half cycles from the meter as they would cause some slight leakage current to flow through D_1. The shunt resistor, R_s is chosen so

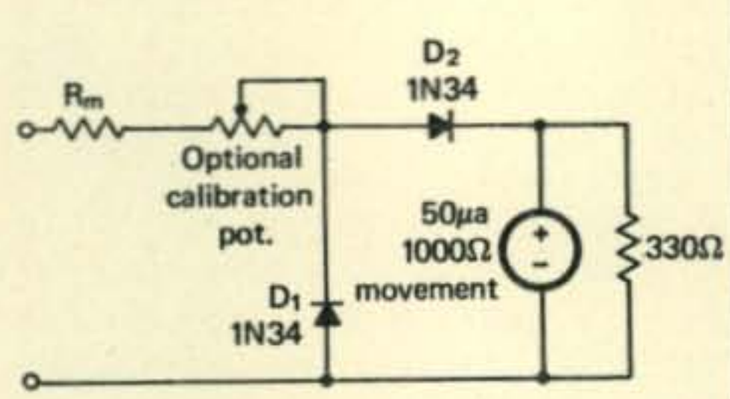


Fig. 3—Basic a.c. voltmeter recommended in text.

that about .25 to .5 milliampere is required for full scale deflection which gives a fairly linear scale. In addition, germanium diodes are used instead of silicon because of their low forward dropping voltages.

After building the basic circuit (without R_m) one should hook up a low voltage calibration source as shown in fig. 4. Alternately, the same transformer, driven by a variac could be used without the 100 ohm pot.

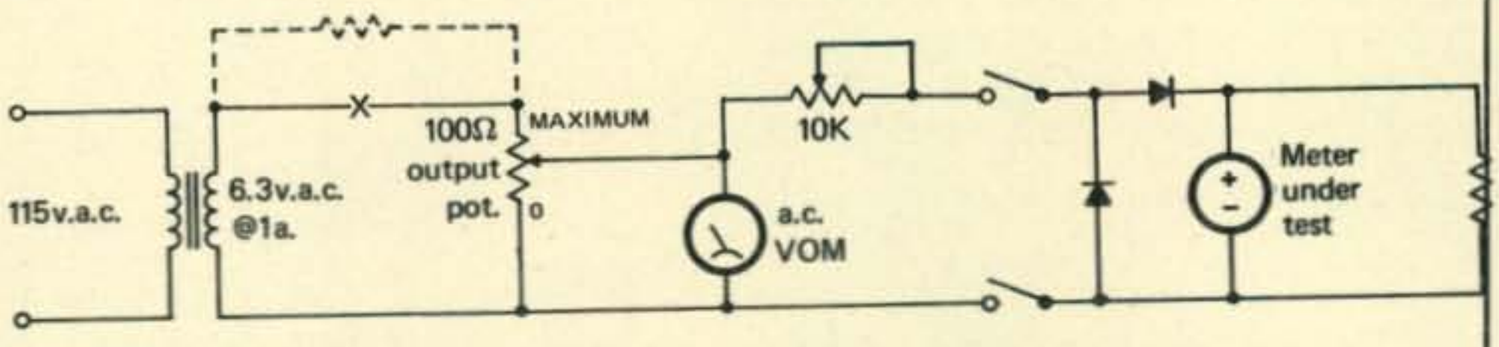


Fig. 4—Simple calibration setup for the a.c. voltmeter discussed in text.

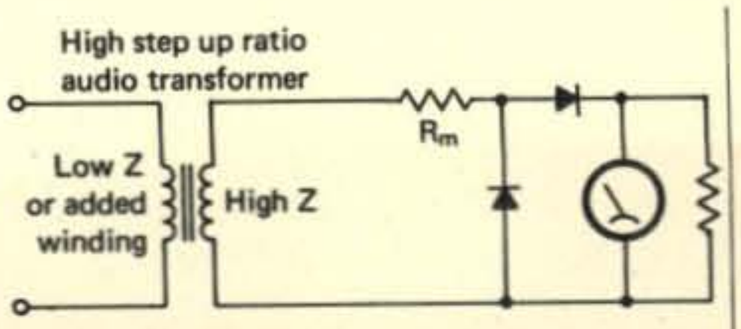


Fig. 5— A.c. ammeter circuit discussed in text. The transformer acts as an a.c. shunt.

Now, with the output set to 0, and the 10K pot set to zero, hook up the basic circuit and slowly raise the output until the meter reads full scale, if this is too "touchy" add 100 ohms—1K in series with point "X" in the diagram as necessary to make it easier. Note the reading on the v.o.m. Now increase the resistance of the 10K pot until the meter reads half scale. Turn off the power, disconnect and measure the resistance of the 10K pot. This is the approximate "internal resistance" of the meter-rectifier-shunt combination.

Now, calculate the rough value of R_m by realizing that 2 × the basic voltage as read on the v.o.m. is necessary for full scale deflection when a value of R_m equal to the "internal resistance" is used. For example:

If the v.o.m. voltage reading was .1 volt and the internal resistance 100 ohms, then 100 ohms would be required for every .1 volts you would want to measure. A 0-10 volt meter (100 × .1 volts) would then require 100 × 100 ohms or 10K for R_m.

When you have the value of R_m approximated, connect a temporary carbon resistor as close to that value as possible and, using the test setup (changing the transformer and pot if necessary) see how close you are. You can then vary the final value of R_m so that you are "right on" or add a pot in series with run as a final calibration control. It will then be necessary to reduce the value of input voltage in order to check on the linearity and calibration of the scale.

If the preceeding seems complicated to you, I would like to add that the variations in diodes, and meters available to experimenters from all types of sources make any other method too uncertain and more formal calculations a bit too complex for this presentation.

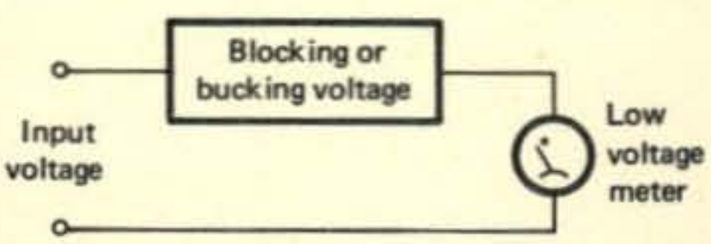


Fig. 6—Basic method of making an expanded scale meter.

A.C. Ammeters

Due to the drops in diodes and basic insensitivity of the a.c. voltmeters just mentioned, the most suitable technique for measuring a.c. currents with those meters, by means of a current transformer. This is nothing more than a simple step up transformer that can be easily implemented by a simple modification of a common audio transformer.

Fig. 5 shows a typical a.c. current setup. The secondary of T_1, a common audio output transformer, is connected in series with the a.c. line to be measured. The high impedance primary is connected to an a.c. voltmeter circuit similar to the one we just covered. A.c. current flowing through the primary generates an a.c. voltage drop across the primary and the transformer step it up to a level that can be read by the meter.

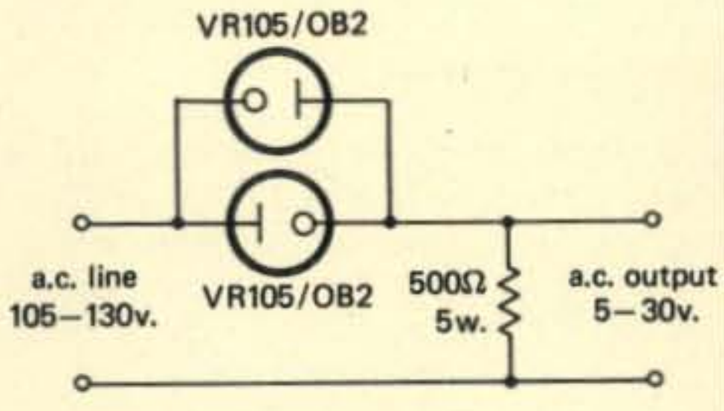


Fig. 7—Expanded scale converter for use with an external a.c. voltmeter.

In this circuit it is important that the secondary be able to withstand the maximum current that will flow and if it is too fragile (wound with very fine wire) it should be replaced by 5-10 turns of suitable gauge wire for the job to be done. This wire, in most cases, can be easily snaked between the existing wire bundle of the transformer and the frame.

Since the readout is still wave shape sensitive, as is the transformer, the same considerations as that of the voltmeter apply. To produce various ranges, you can change the sensitivity of the a.c. voltmeter section, or the turns ratio between primary and secondary.

Due to the vast differences in components on hand, this is a true experimenters delight. One word of caution however, be certain to always check the linearity of the readings when using this method—never assume it is perfect.

Expanded Scale Meters

Often, it is desirable to read only a small portion of voltage out of a much higher voltage such as the nominal ±10 volt variation in the normal 115 volt a.c. line. An expanded scale meter is just the ticket for this sort of application.

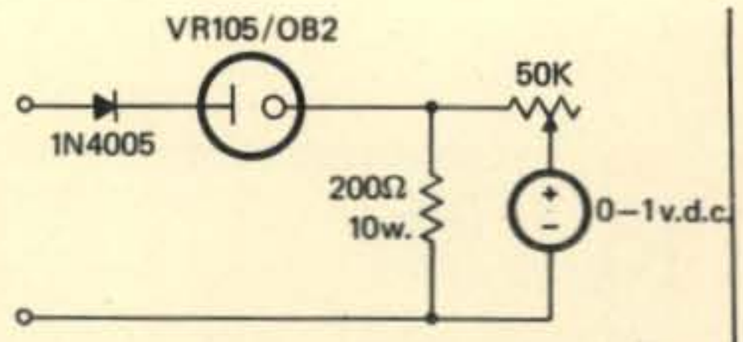


Fig. 8—Simplified a.c. line voltage meter.

Fig. 6 shows the basic concept for building expanded scale meters. All that is needed is a method of blocking the amount of voltage not important and measuring the balance. For this purpose, the zener diode or Voltage Regulator tube is perfect.

In fig. 7 we have a circuit for measuring the a.c. line. Two 105 volt VR tubes are connected in parallel (one for each half cycle of the a.c. line) and in series with a fixed resistor. The tubes will be dropped across the 500 ohm resistor. A 0-30 volt a.c. meter connected across the 500 ohm resistor will now indicate "0" at 105 volts and "30" at 135 volts making a very useful expanded scale voltmeter.

A simplified version of the line voltage meter is given in fig. 8. Here, a single VR 105, a silicon diode, and a d.c. movement are used to make an expanded scale voltmeter. Operation is similar to the previous circuit in that the VR tube drops the bulk of the voltage. The diode assures only half cycle operation and the 200 ohm resistor acts as a load for the diode. To calibrate simply apply 130 volts, and adjust the 50K pot for full scale reading. They lower the voltage in steps to calibrate the scale.

For our final example, let us refer to fig. 9. Here a zener is simply connected in series with a d.c. voltmeter. As in the past examples, the zener blocks all voltages up to its approximate zener point, and allows all additional voltage to pass. In this circuit, there may be some nonlinearity around the zener point.

73, Irwin, WA2NDM

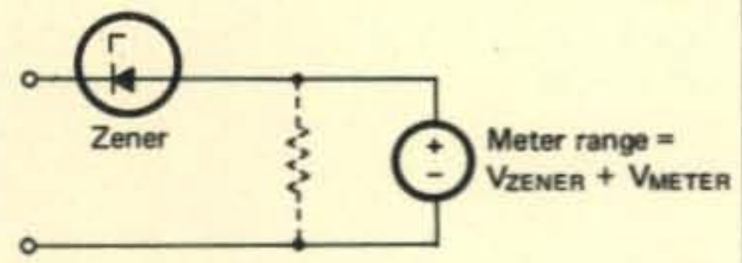


Fig. 9—Expanded scale d.c. meter. The optional shunt resistor is used when the basic meter does not draw enough current to assure proper zener action.

WILLIAM I. ORR, W6SAI, ON

Antennas

"Welcome back," cried Pendergast. "How was your vacation in Hawaii?"

"Great!", I admitted. "Lots of beach weather . . . watching the *Wahinis* in their Bikinis . . . that good *Primo* beer . . . Maui potato chips . . . and a little DX to boot."

"I know about the *Wahinis* and *Primo,*" said Pendergast, as he settled comfortably down into my operating chair. "Now tell me about the DX."

"Well, it really wasn't that good," I replied. "I got on the air at the start of the *CQ* WPX Contest, right in the middle of the big solar radio blackout! That was a hairy experience.

"The Thursday (March 25) night before the contest started 20 meters was wide open. The VKs and ZLs were very loud, and they had a flutter on them. The signals sounded just like aurora propagation. It sounded like 6 meters, not 20 meters. Also, a lot of deep Asian DX and European DX was coming through with the same flutter."

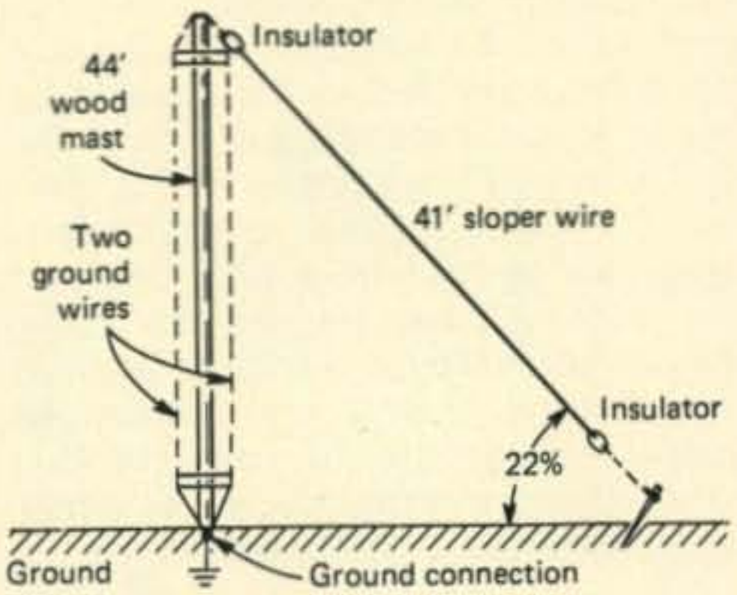


Fig. 1—Inexpensive 80 meter sloper antenna of K6UB. A 44 foot wood mast is used. Two ground wires are brought down from the top of the mast. The 50 ohm transmission line runs up the mast, with the shield grounded to the ground wires. The center conductor is attached to the sloper wire. Length of the wire and the base angle were adjusted to provide the lowest value of s.w.r. at 3800 kHz. A similar antenna is used at WA6PLW.

"What about Friday and Saturday when the contest started?" asked my friend.

"Saturday morning, 20 meters was absolutely flat! Not a signal, except one from South Africa! the ZS6 was the *only signal* on the band, except for one or two locals. Odd that he should come through. Except that he was at the antipodal point on the globe from Hawaii. Possibly his signals were arriving on a north-south path. After he QRT, the band was completely dead for several hours. It began to come back about noon. I talked to Pete, 5W1AZ, in Samoa, and the band came back to life quicker there than it did in Hawaii.

"The first signals I heard from the States were W7s in Washington, VE7s in British Columbia and W6s in the San Diego area. The whole middle section of the West Coast—from Oregon to Los Angeles—was blacked out. Then, slowly, the blacked out area shrank. I began to hear Los Angeles and Oregon. Then stations in central California. The last area to come through was around San Francisco. I didn't hear anything from the San Francisco-San Jose area until about four in the afternoon."

"That's weird," pronounced Pendergast.

"I agree. We are still victims of the ionosphere, for better or worse. And that's what makes DXing a lot of fun . . . the unpredictability of it."

"George Jacob's *Mail-A-Prop* hit it right on the nose," said Pendergast. "He predicted the disturbance, stating the radio storm would begin on March 25th, and said "the bands would be in pretty bad shape." That was the understatement of the year."

"*Mail-A-Prop* is a very handy operating aid for the DXer," I replied. "It saves a lot of wear and tear on the nervous system."

Pendergast sighed, relaxed, and placed his feet atop the polished surface of my operating table. He pushed the electronic key aside with the toe of his boot.

"What's in the mail today?" he asked.

"Well," I replied, "There's still a lot of interest in the 80 meter sloper antenna. That's the quarter-wave wire that uses the supporting tower as a return ground (fig. 1). A lot of fellows are using it, and it seems to be working well for them. As far as I know, W6NLZ was the originator of the antenna.

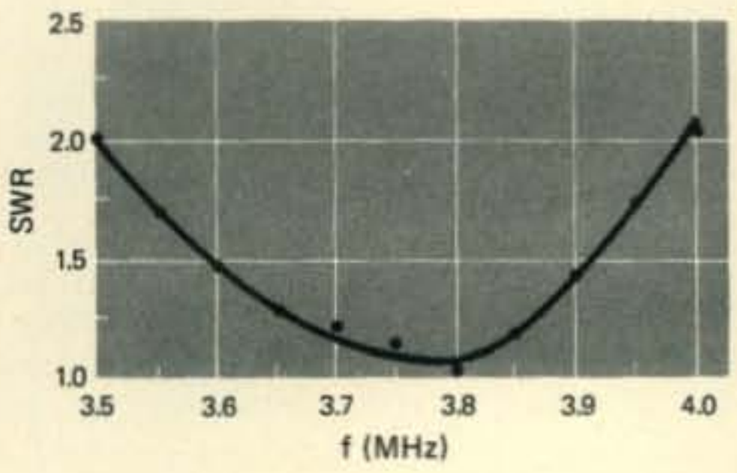


Fig. 2—The s.w.r. curve of the 80 meter sloper used at K6UB.

"I received a nice note from Hu, K6UB, who says, 'For years I've been trying various versions of 80 meter antennas all with disappointing or mediocre results . . . birdcages, fans, bowties, coaxial, folded dipoles, etc., etc. with never more than 400 kHz bandwidth, and usually less.

'Recently I tried out a sloper at WA6PLW. I had to trim the wire to 48 feet to resonate about 3750 kHz. The s.w.r. was 1.4-to-1 at resonance and about 2-to-1 at the band edges. On the air tests brought good reports.

'This encouraged me to try it at my own QTH. I have a 44 foot wooden mast, so I hoisted the sloper to the top and brought down two ground wires in lieu of the metal tower. I grounded the two wires to separate

ground rods and also grounded the coax braid at this point and connected the whole works to the irrigation pipes in the sprinkling system and to a low, woven wire fence!

'To get best bandwidth, and to hit resonance at 3800 kHz, I trimmed the sloper wire to 41 feet and set the angle at about 22 degrees (fig. 2). On the air reports were excellent and the whole 80 meter band is covered with an s.w.r. of 2-to-1, or less, across the whole band. Thanks for a great idea!'

"No credit to you," observed Pendergast archly.

I ignored the thrust, and continued. "Here's a second note about the W6NLZ sloper from Bob, WB4-DPG/5. His sloper is pictured in fig. 3. He says the effect of guy wires on the sloper is worthy of interest, as he has achieved directivity by the proper placement of tower guys. He also says that the feedline should run down the tower to the ground, and then take off to the shack. If the feedline is taken off the tower at a point above the ground, or is brought off at an angle to the antenna, there's a good chance the shack will be full of r.f., with the attendant feedback problems. This holds true for other feedlines to any antennas on the same tower as the sloper. They should be brought to the bottom of the tower, near the ground, before they take off to the shack.

"Bob says that he can tune his sloper on 40, 20 and 15 meters using a Drake MN-4 Transmatch with very little trouble. He's sure the s.w.r. on the line is quite high using this stunt, but he's only running about 200 watts and nothing gets hot, or gives any problems."

"Very interesting" remarked Pendergast. "Obviously the sloper antenna is an unusual one, and we haven't learned all the tricks about it yet."

"Anyone can play," I replied. "The ground rules are simple. The wire is about a quarter wavelength long, or less. The height of the feedpoint above ground, the included angle and the height of the end of the antenna above ground are the variable factors, none of which seem very critical. One or more of these dimensions is adjusted to provide the lowest s.w.r. at the desired operating frequency and the best bandwidth. S.w.r. at resonance seems to run in the range of 1.2-to-1 to 1.5-to-1. The base of the supporting tower should be grounded and all other wires and cables on the tower should be brought off near ground. And, finally, supporting guys on the tower

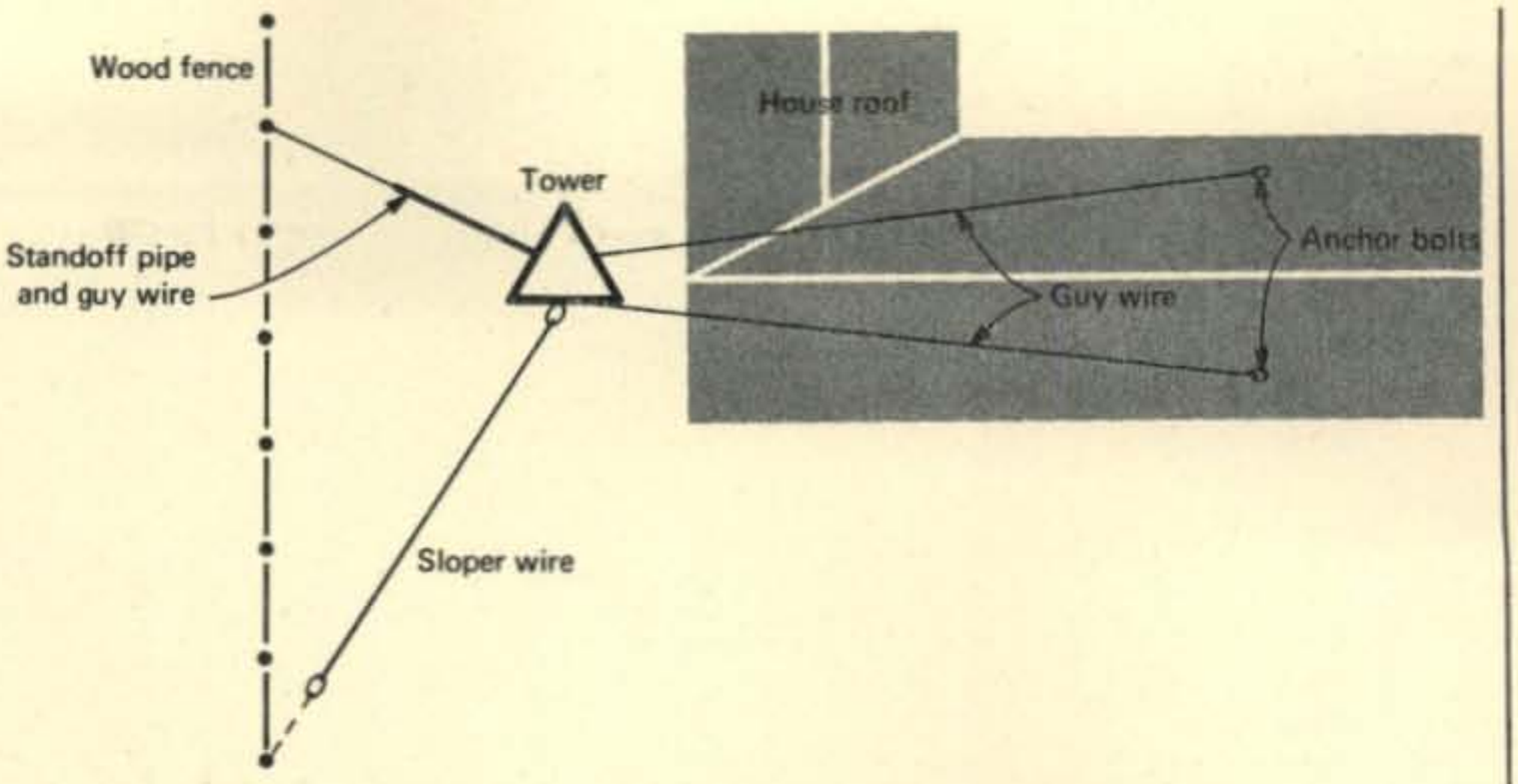


Fig. 3—The 80 meter sloper of WB4-DPG/5. The sloper acts as one guy for the metal tower. Two guys run to anchor bolts in the house roof. The fourth guy is run from the tower top to a standoff pipe on the tower and then down to the base of the fence. This is done to keep the guy wire on the property. Using an antenna tuner, the sloper works well on 80 thru 15 meters. The guy wires are not broken with insulators and tend to act as reflectors for the sloper antenna.

should be broken up with strain insulators, otherwise they impart a directive effect to the sloper. You can take it from there."

"Has anybody used the sloper on 160 meters?" queried my friend.

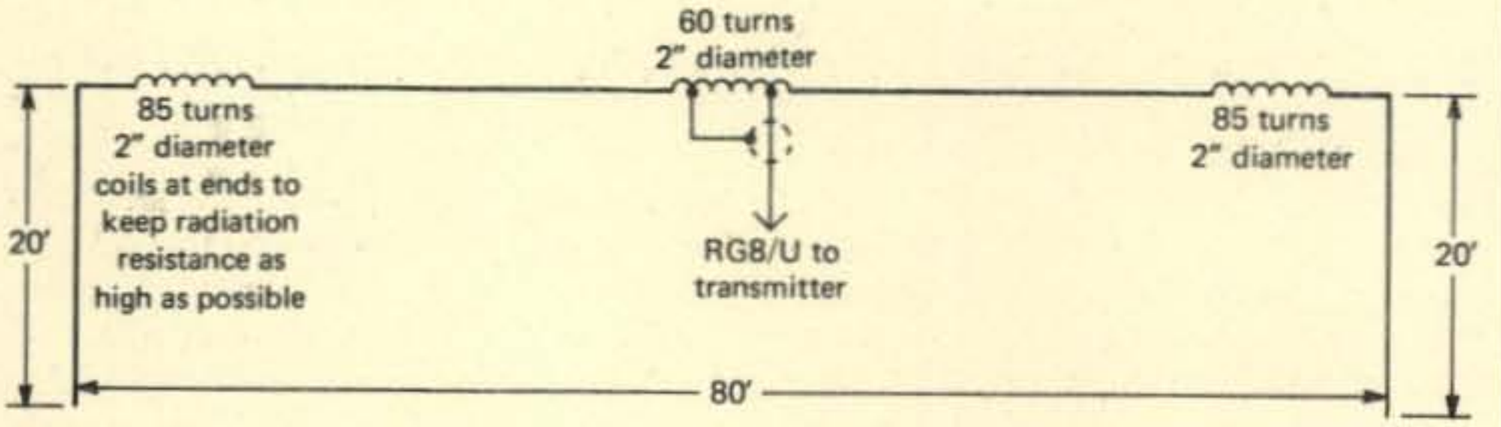


Fig. 4—The W6TAT compact dipole for 160 meters.

"Not that I know about, but one cut to that band should work OK, I would think." I paused and sorted through a stack of letters.

"Here's an interesting note from Rick, W6TAT. He's using a short, loaded dipole on 160 meters, which gets away from the radial and ground problems (fig. 4). The compact dipole is only 80 feet long, with 20 foot end sections. The feed system is the balanced counterpart of the popular tapped-coil match used for mobile whip antennas. The operational bandwidth is about 100 kHz between the 2-to-1 s.w.r. points.

"The adjustment procedure is simple. Before the feedline is attached, the antenna is resonated to the center of the operating range by pruning the center coil, while grid-dipping it. Next, the braid of the coaxial line is attached to the center of the coil and the center conductor of the coax is tapped at a point on the coil which provides a 50 ohm match. This adjustment can be done with a Noise Bridge or an s.w.r. meter. If adjustments are done with the antenna low enough to reach the center coil, it may be readjusted by trimming the end tips once it is hoisted into final position."

"I like that antenna," said Pendergast. "Most fellows have problems on 160 meters because they use some sort of vertical, or Marconi, and run into huge ground losses." He scanned the letter, "Rick says that this mini-dipole provides reports equal to his vertical antenna and he gets excellent signal reports with his schedules, which run out to about 400 miles."

"It should be good for a lot better DX than that," I remarked with a smile.

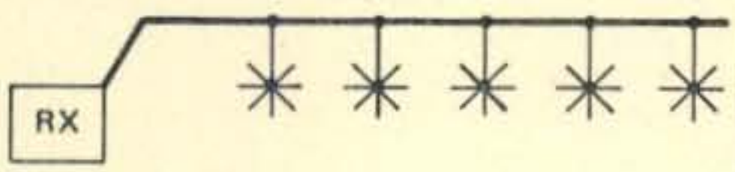
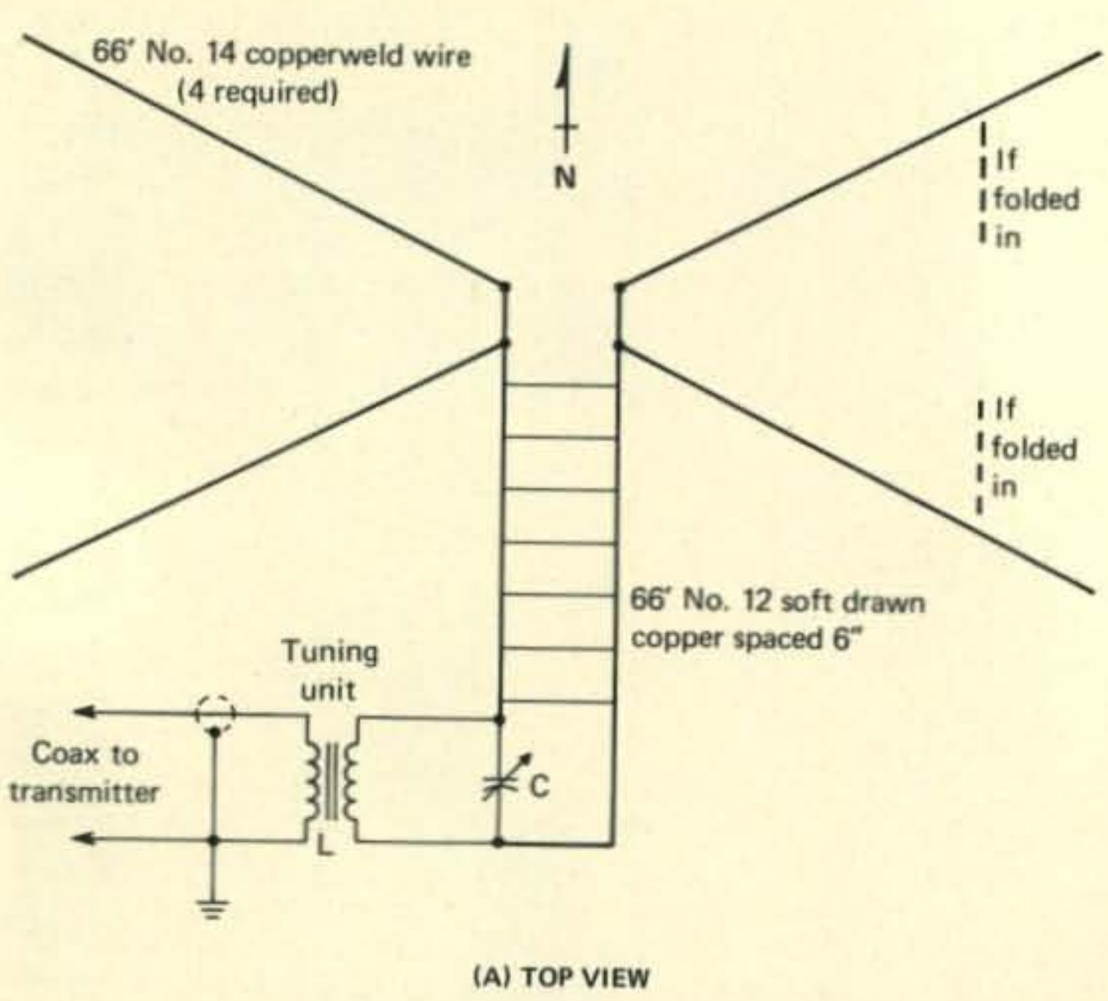
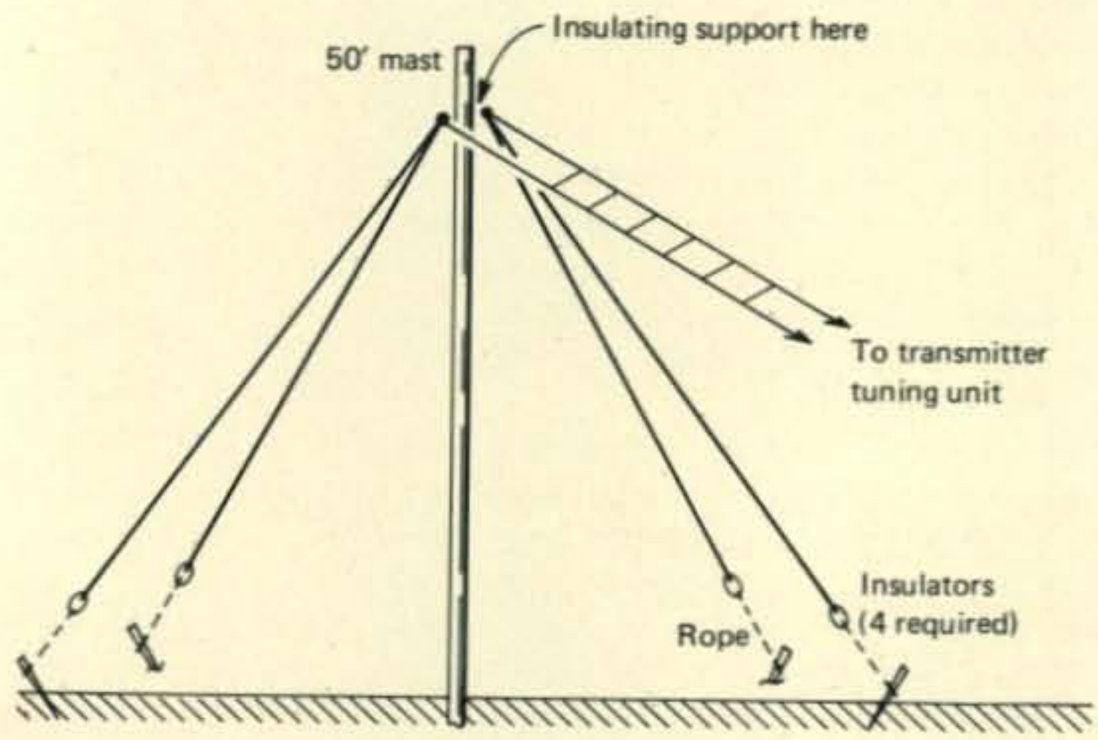


Fig. 5—The old timer's "cat whisker" receiving antenna of the "twenties" remembered by WA4LCO (ex-W8LCN).



(A) TOP VIEW



(B) SIDE VIEW

Fig. 6—The WA4LCO multiband antenna. This center-fed, double inverted V antenna works 80 through 10 meters. It is supported on a 50 foot push-up TV mast. A 66 foot long, spaced feeder system is used in conjunction with a simple antenna tuner. The L-C combination tunes to the band in use. WA4LCO has made 5-band DXCC with this simple antenna.

"Before we leave low frequency antennas, you might be interested in the letter from Ken, WA4LCO. Ken says, 'My earliest recollections of radio were the days when everybody built their own equipment (BC as well as amateur). My father assembled his own variable capacitors and my uncle made his own audio transformers by taking a bundle of iron wires, winding primary and secondary around the middle of the bundle, then bending the ends of the bundle around the windings to interleave outside the windings and complete the magnetic path.

'My uncle also had his favorite receiving antenna (fig. 5) which he called a "catwhisker aerial." Every so often a short piece of wire was soldered to the antenna wire and at the end of the wire, six or eight shorter pieces were soldered and stuck out in various directions. This was in the early twenties. I guess the idea was to get as much copper in the air as possible.'

"Wild," said Pendergast.

"The antenna that WA4LCO uses has a lot of copper in the air, too (fig. 6). It is a center-fed, double inverted V, using tuned feeders and a *Matchbox* tuner. Ken has 5BDXCC with it. Not bad! He says the antenna works well 80 thru 10 meters and does not seem to show any directional effects. Only one support is required, and he uses a 50 foot telescoping TV mast. Two antenna ends are tied to a fence and are only about 5 feet above the ground. The other two ends would normally land in the front yard, but he didn't want them there, so they are bent back and run along the edge of the roof. Ken says the whole thing is fairly inconspicuous and several neighbors have asked him when he was going to get his TV antenna mounted on the mast! Ho, ho."

"That's a nice antenna that can disguise itself as a TV mast," remarked Pendergast. "A TV antenna could go at the top, and the feedline could come down inside the mast, if that shielded 300 ohm line was used!"

"Pretty sneaky," I replied. "But sometimes subterfuge works wonders in an up-tight neighborhood!"

Pendergast's attention seemed to stray, and he did not reply. Instead he rose out of the chair and in one gesture reached up on the shelf and clutched a small object.

"What's this gadget?" he demanded, examining it closely. (Fig. 7).

"It's a mini-s.w.r. meter," I replied. "In this age of rising costs, it is the *Buy of the Month*. About ten dollars."

"A bargain," remarked my friend. "What's inside the case?"

(Continued on page 72)

Fig. 7—The new Swan miniature s.w.r. meter sells for about ten dollars. Just the thing for portable or Field Day use. It is rated to 1 kilowatt up to 21 MHz and 500 watts up to 30 MHz.

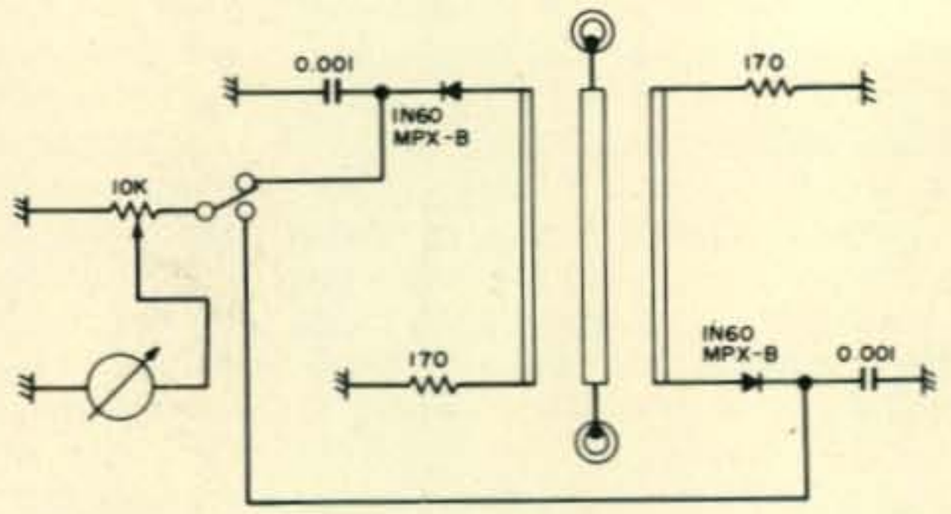


Fig. 8—Schematic of the miniature s.w.r. meter. Components are mounted on a compact printed circuit board.

Novice

BY HERBERT S. BRIER, W9EGQ

One of the most frustrating experiences of a radio amateur is to hear other operators working stations the signals from which are covered up by man-made noise in his receiver. The sources of the noises are automobile ignition systems, electrical power lines, television receivers, elevators, sewing machines, neon signs, digital clocks, electric blankets, X-ray machines—virtually any device carrying or utilizing electrical power. The causes are sudden and repetitious change of current. Spark plugs fire, a motor armature interrupts current many times a second, a tree branch rubs against a power line, the contacts in a thermostat do not break cleanly; all these happenings can generate a series of highly-distorted electromagnetic fields to a conductor connected to the device. The conductor, in turn, acts as an antenna to radiate these noise fields into space. When the noise fields are weak and the conductors are short, the noise travels only a short distance, but when the fields are strong and the conductors are long—such as a power line—the interference can travel a mile or more.

U.S. Representative Vanek and Senator Goldwater are sponsoring bills to force manufacturers of electrical and electronic equipment to curtail the amount of radio frequency interference (RFI) it emits. Even if the bills ultimately become law, they will have no immediate effect on the noise in your receiver; so reducing it is up to you.

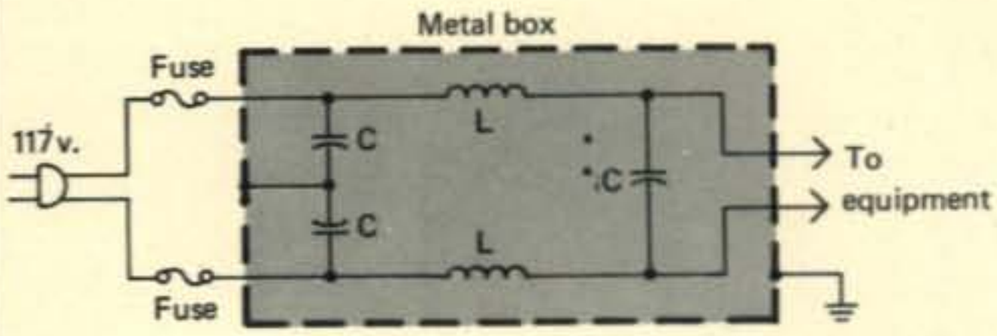
Before the days of s.s.b. phone, all communications receivers had a diode noise limiter between their second detector and first audio stages. It did a fair job of knocking the peaks off of automobile ignition interference when receiving conventional a.m. phone but was ineffective when receiving s.s.b. and c.w. signals: consequently it was quietly dropped from modern amateur receivers about ten years ago. However, back in the 30's James Lamb invented the much-more complicated "Noise Silencer." The silencer amplifies and rectifies the noise pulses picked up by the receiver and feeds them to a "noise gate" at the input of the receiver's first i.f. amplifier. When a noise pulse hits the gate, the receiver is disabled for its duration. On sharp impulse-type noises, like automobile ignition interference, in which each pulse has very high amplitude but is very short in duration, a good noise silencer or noise blanker can transform a signal that can barely be distinguished under the noise into a fully readable signal accompanied by a little noise in the background. On other types of noise, the blanker can totally or partially ineffective, depending on the duration and repetition rate of each noise pulse. As a result, noise blankers are invaluable for mobile operation, quite useful for locations near busy streets and highways, and of variable usefulness in other locations.

Locating Noise Sources

The first step in tracking down noise sources is to remove the antenna from the receiver temporarily to establish that the noise is actually getting into the receiver via that path. If it is getting into the receiver via the power line, it may be reduced with a filter in the power line of the receiver or of the offending device. A filter may take many forms. A suitable receiver filter may consist of two 150-turn coils of No-18 enamelled wire close wound on 5" × ¾" phenolic or plastic forms, one in each conductor of the power line. Connect a .01-uμ, 1600-volt (or higher) capacitor from the line end of each coil to the shield box and another .01-μf 1600-volt or higher capacitor across the other ends. Connect the metal box to the receiver cabinet and to a good low-resistance ground.

Use the best receiving antenna available. Most amateurs do this automatically by using their transmitting antennas for receiving, also. However, if the transmitting antenna is vertical, it will probably pick up more noise than a horizontal receiving antenna would. Locally-generated noise signals are vertically polarized and originate from sources close to the ground, which are usually closer to a vertical antenna than to a high horizontal antenna. Whether the antenna is vertical or horizontal, feed it with coaxial or low-impedance twin-conductor cables for minimum noise pickup, because they do not pick up additional noise even when passing through heavy noise fields.

Start looking for noise sources in your own home by unplugging each appliance from its wall socket while listening to the noise from the receiver loudspeaker. Do not just turn



LEGEND·
C = .005μf — .1μf, 1600volts.
L = 150 turns, ½" to 1" dia., close wound.

Fig. 1—General schematic diagram of RFI filter to be inserted in power line of receiver or interfering equipment. Bond metal case to the equipment case for safety and maximum effectiveness.

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the appliance switch off: the problem may be caused by a defective switch. Also, many TV receivers are not really off when the switch says "off." Their tubes are still partially energized for quick warm up when turned on. Thermostats of electric blankets (some people never turn them off), frost-free refrigerators, aquariums, and other automatic switches are frequent sources of RFI, because their contacts do not always break cleanly and arc lightly.

You do not need a great deal of elaborate equipment to search for noise outside your home. Cruise up and down the streets and alleys near your station in an automobile while listening to the radio tuned to no station for noise. We found a "power leak" in a maze of overhead wires at a corner four blocks north and two blocks east of our new location within five minutes after starting the search. It took the power company longer to correct the problem, but it was done in a few weeks. A transistor portable radio is also a good noise snooper. If it tunes a couple of shortwave bands in addition to the BC band, fine, but not really necessary. When the noise is intermittent, it is sometimes helpful to record it on a tape recorder for the information of the power company representative.

When the noise source is suspected to be in someone's house, the quickest way to test the suspicion is to pull the entrance power switch while monitoring the noise. If the noise goes off with the power, you are on the way to success. For example, Steve, WA9EZJ, was plagued with a 24-hour-a-day "BZZT-BZZT" racket finally tracked down to a home on another street. The homeowner had put an electric blanket in her cat's box to keep the new kittens warm and had forgotten it. It had a defective thermostat.

News And Views

Hopefully, **Lou K8IQB,** 202 Howard St., Bellevue, Ohio 44811, will benefit from this month's column. He is plagued by buzzing, rasping, on-again-off-again noises that interferes with working DX on 20 and 15 meters and working Novices on 15 meters. He would like to arrange with any interested amateur to organize a noise hunt; so he can start working the stations that he hears just under the noise . . . In the light of the present FCC rules that the log of an amateur station need only include the call sign of the station, the signature of the station licensee, the dates on which fixed operation of the station is initiated and the primary call sign of duty control operator, the following remarks of **Dave "Mid" Middleton, W7ZC,** are appropos: The FCC rules changes about logging have not reduced the necessity of keeping an accurate log in an efficient amateur station. I have used every log scheme under the sun, but 45 log books ago, I settled on the ARRL standard-size logbook, because of its uniformity and universal availability from amateur radio suppliers or from ARRL by mail. It contains 39 log pages of 29 lines, plus GMT to local time charts, RST report data, the ICAO phonetic alphabet, and a list of useful Q signals, as well as other material. I suggest numbering each of your QSO's consecutively, and follow the lead of W6ULS/K6DC by logging all of your non-USA contacts in red. Use GMT or UCT, rather than local time, to log all contacts. A digital clock set to Universal Time, makes this easy to do, and is essential if you hope to work much foreign DX. Remember you will be an amateur for a long time, and your logbooks are the history of your station.

Tom Gannon, WN4HHJ, 291 S. Lorraine Drive, Mary Esther, Fla. 32569, started to become a radio amateur in 1935 at the age of 15, but one thing and another prevented him from achieving his goal then. But 40 years later as a retired USAF and Airlines navigator, Tom become WN4-HHJ. He has earned WAS (Worked All States), WAC (Worked All Continents), and the WPNX (*CQ* Novice Prefix Award) using a Heathkit HW-16 transceiver and HG-10 v.f.o. in conjunction with a homebrew, 3-element beam. Tom is waiting for his General class license and still studying code and theory. He plans to stick mostly to c.w. until he is ready for the Extra class license . . . **"Kroppy," VE6UP,** Lethbridge, Alberta, Canada, corrects a misunderstanding that the optional use of the prefix "XJ" by Canadian Amateurs during 1976 is in commemoration the Canadian Bicentennial. Rather, it is in recognition of the Summer Olympic Games in Quebec this summer. We have been informed that a special amateur station will be operated from the Olympic grounds during the games, but we do not get its schedule in time to include in this column.

New License Study Guides

In late March, the FCC released new study guides for Element 2

(Continued on page 72)

In Focus

BY BILL DEWITT, W2DD

'Twas The Night Before Dayton—

Writing copy for the June issue in Early April with the Dayton Hamvention/SSTV Seminar about three weeks hence, is like writing a story on mid-century caterpillar migrations when you know that a practical solar-powered automobile is going to be announced tomorrow! I'm sure that slow scan innovations will run rampant at Dayton, so stand by for more info in the July issue. "In Focus" will bring you news of all the "goodies" and what they'll do.

G3IAD Makes It 100 Countries On 2×SSTV!

Neville Jackson, G3IAD, of Nottingham has acquired the distinction of being England's first slow scanner to ring up a century score. I believe he's the first in all Europe and third in the World too.

It's tough enough to work Turkey on other modes, but it was TA2MM that Neville hooked for number 100. Congratulations Neville! (TA2MM's name is Fred, and his QSL manager is DJ0RR.)

More News From England

G2BAR and G3KFN have received the first two Robot 300s to arrive in England. G2BAR and G3WW received permission to operate with a

Fig. 1—Jean Nicolas, F6BDJ gives the signal for stereo SSTV transmissions.

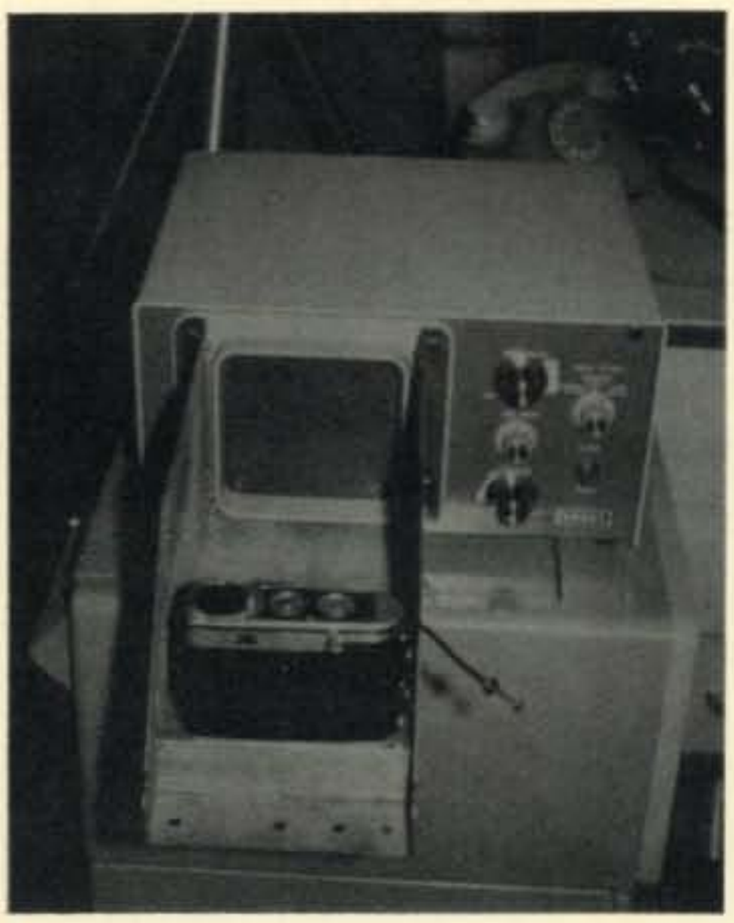

Fig. 2—"Drop-On" camera mount used by W2DD to photograph slow scan screen.

256 line picture and had the first two-way 256 line SSTV QSO in the UK on 80 meters back in March.

G3WW's WB9LVI type scan converter is now functioning very well with a 625 line fast scan output. Richard (G3WW) reports that the last few remaining bugs are being cleaned up and he is delighted with the pictures he's getting.

QRP SSTV By F6BDJ

W4MS reports receiving stereo pictures of Jean Nicolas, F6BDJ, of Grenoble in a recent QSO. Jean, shown giving the V for Victory sign in the accompanying photo, does everything with style — his stereo transmission to W4MS was with **one watt** output! Jean now sports two complete stations, a Triton 2 and a Heathkit SB-104. I'll have more on F6BDJ and how he's handling slide transparencies for slow scan transmission in an early issue.

New Countries On SSTV

In addition to some of the above items from England and France, my far flung correspondent, Eddie Collins, W4MS, the pride of Pensacola also reports that 5B4HS and M1I will be on SSTV very soon. Seems like the old days of s.s.b., with a few new countries every week.

Non-Ham But Very Interesting

Functional Photography Magazine's March 1976 issue carries an abstract of a *New Scientist* (Brit.) *Magazine* article reporting a new kind of glass that may find important applications in the TV camera field.

Photochromic glass is glass that darkens when light falls on it. Sun glasses employing this kind of glass have been available for some time. However, a very rapid acting photochromic glass has now been developed that responds within 100 nano-seconds to reach an absorption of 99 per cent! Full recovery is slower, taking one or two seconds.

As pointed out in the *Functional Photography* article, the extremely fast response of the glass to high light levels suggests its usefulness for simplified exposure control systems and as a protective device to prevent vidicon damage when press photographers point their flash cameras directly into the TV camera. I suspect that Warren Weldon, W5DFU, who has done much in the televising

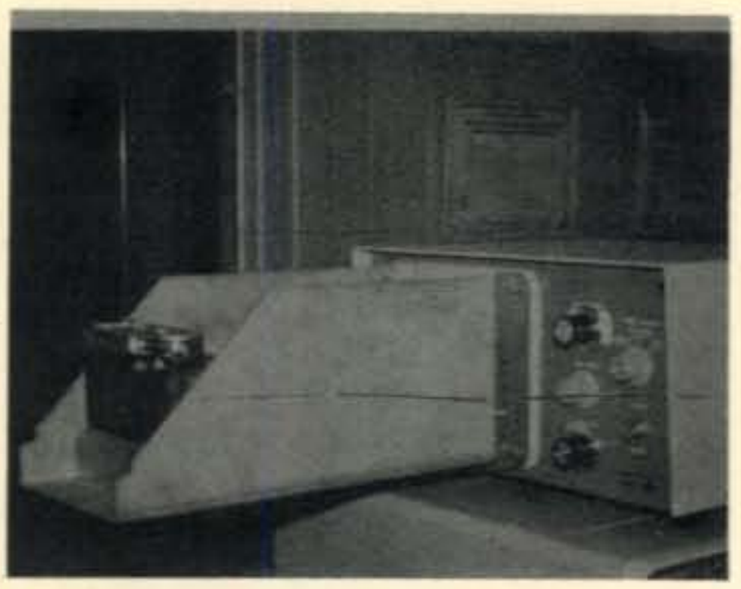

Fig. 3—Another view of W2DD's camera mount showing spacer under camera to align optical axis of camera with CRT screen.

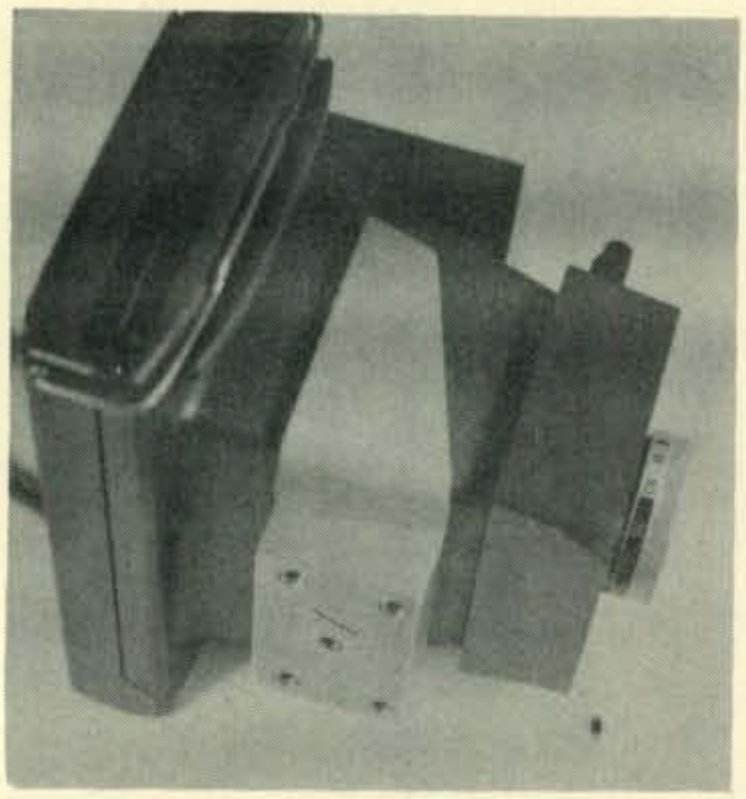

Fig. 4—Aluminum yoke cemented to the body of a Polaroid Square Shooter camera provides a rather elegant tripod mount.

of lightning flashes will be angling for a test sample of this British made product before long!

Very Low Light Level, Low Bloom CCTV Camera Announced

Another non-ham item worth hearing about is RCA's newly announced TC1030/H camera which gives useful pictures from quarter moonlight (!) to full sunlight without highlight bloom.

Equipped with a new low-bloom RCA Silicon Intensifier Target (SIT) vidicon, the camera's high sensitivity can give useful pictures in light levels as low as .00015 foot candles. Its dynamic range of 100 million to one with auto iris lens gives it around-the-clock utility. Low bloom means bright scene highlights won't obscure useful picture information.

The user price of the new camera varies from $6490 to $8850 depending upon lens option, but some of you industrial types may well have a use that justifies that kind of money!

Photographing SSTV Images

During the past few months I have received several inquiries in regard to photographing SSTV images. There seems to be a long-standing bugaboo about any kind of close-up photography—and it applies to amateurs who would like to take pictures of their SSTV images, but are somehow reluctant to try!

It really is fun to be able to send an off-the-screen photo of received pictures back to your friends at the other end of the line. It's also advantageous when discussing SSTV with your non-ham friends to be able to show them a picture of what you are talking about.

During the past six years, I have photographed SSTV images with Kodachrome-X, Ektachrome-X, Kodacolor-X, Hi Speed Ektachrome, and the Polacolor products. In black and white films, I have used Kodak Panatomic-X, Tri-X, and Polaroid's 87, 105, and 107 films. Cameras used include a Kodak Signet-40, a Retina Reflex IV, two Speed Graphics, and several Polaroid cameras. What's the message here? That Bill DeWitt is a great photographer? NO! The message is that you can use almost any camera or film to photograph your SSTV images. It isn't all that special!

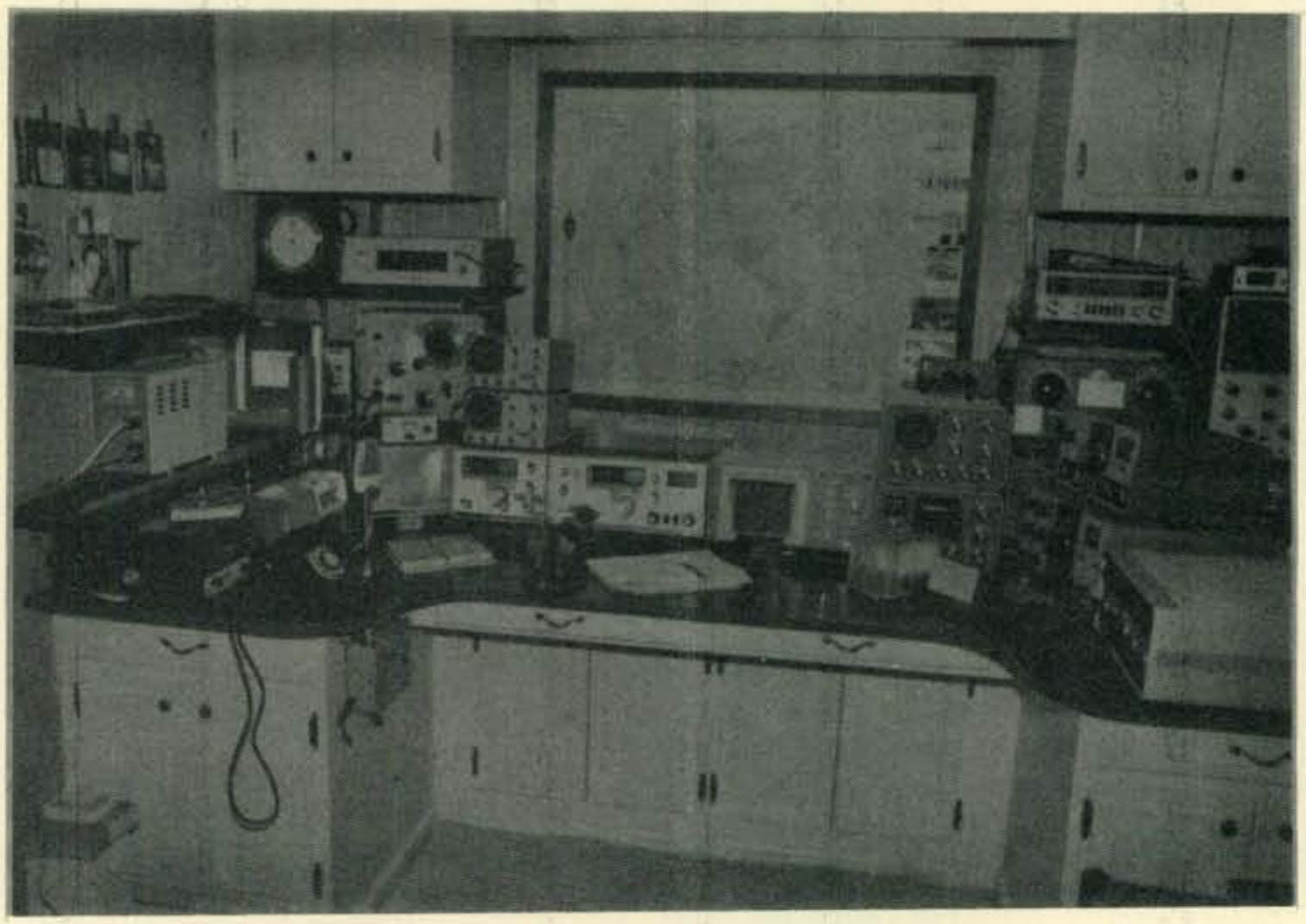

Fig. 5—Beautifully equipped shack of K4FZ.

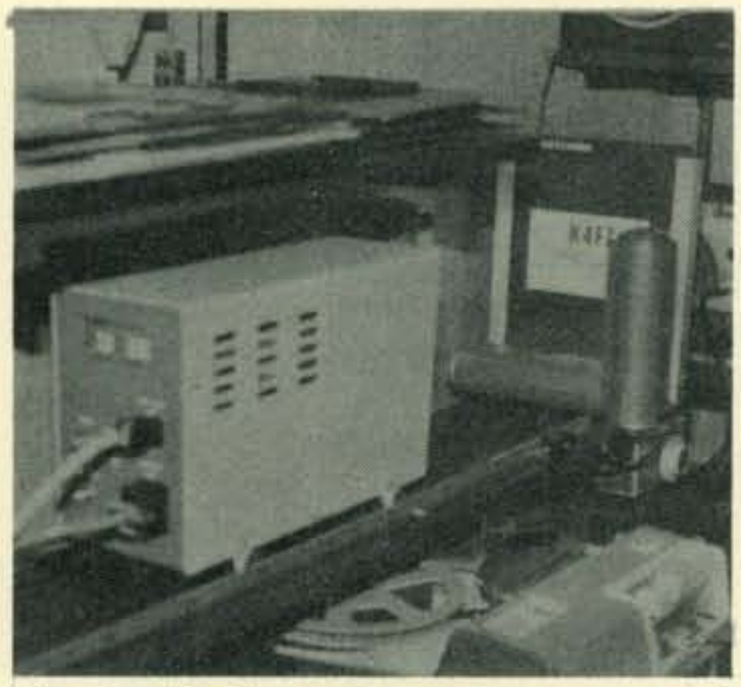

Fig. 6—Nicely engineered camera track and flat copy set-up used by K4FZ.

Getting Down To Fundamentals

The principal requirements for SSTV film photography are a solid support for your camera and a close-up attachment for its lens. Another obvious need is a means of controlling the shutter so that 8 second exposures can be made.

Supporting The Camera

There are several ways to support your camera. You can use a pedestal type mount, a tripod, or a monitor-mounted frame. Figures 2 and 3 show two views of a simple camera mount that I have used for some time. Two right angle brackets are mounted permanently on the monitor front. (I found it necessary to get some slightly longer screws.) A small screw is inserted near the top of the protruding edge of each bracket. The screw body provides sort of a hanger to match a cut out area on the U shaped camera holder. In this way, the camera bracket assembly can be dropped on or removed from the monitor in seconds.

Having determined the camera to screen distance as described below, the camera is left attached to the U shaped bracket except for film loading/unloading operations.

Venus Scientific sells a Polaroid Square Shooter camera mount that snaps onto their monitors, very neat.

A little ingenuity can help if your camera doesn't have a tripod mounting fixture. Fig. 4 shows a rather elegant way of solving the problem, but you can do a lot with a block of wood and some epoxy cement!

About Close-Up Attachments

So far as close-up attachments are concerned, here's a suggestion; The next time you remove the film from your camera for processing, take a moment to see how large the SSTV image is at the minimum focus distance on the camera. And check to see what effect a close-up attachment has on the image size. How can you do this?

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To make the image at the film plane in the camera visible, you will need a piece of ground glass or some similarly translucent material. Scotch tape this material in place where the film would ordinarily be. Set the lens diaphragm wide open, and you're ready to find out how things look.

Neat trick: To make it much easier to see what you're doing, cut out a piece of newspaper or magazine advertisement the exact size of your screen. Scotch tape it to the screen UPSIDE DOWN. Now, when you look at the image displayed at the film plane of your camera, you will see a right side up image for focusing and size evaluation purposes.

Once you have everything all lined up in this respect, remove the paper from the monitor screen and you are ready for picture taking.

Single Lens Reflex Cameras Simplify Things Terrificly!

If you happen to be the owner of a single lens reflex camera, life is much simpler. You can snap on a close up lens, take a peek through the viewer, see what you're getting and make adjustments accordingly. Same goes for any camera with a ground glass viewing screen.

Watch Out For Reflections

Reflections of bright objects in your shack may show up on the CRT screen (and in any photo of course), so check that point out before you push the shutter control. A dark cloth over the top of the camera mounting is sometimes needed.

How To Defeat A Photoelectrically Controlled Shutter

It's easy. Just stick some black tape over the photo-cell, hold the shutter open by pushing down on the control, and let up at the end of the eight second frame, but don't jiggle the camera during the exposure!

What Lens Setting Do I Use?

A lens diaphragm setting of about f8 or f11 is a good starting point for exposures made using films having an ASA rating of 75 to 125. (Kodak Plus X, Kodacolor II, Polaroid 88 color film, and Polaroid Negative-Positive 105 film, for example.)

The cheaper cameras like the Polaroid Square Shooter or Zip models have a lens aperture of approximately f11, so don't worry about

(Continued on page 73)

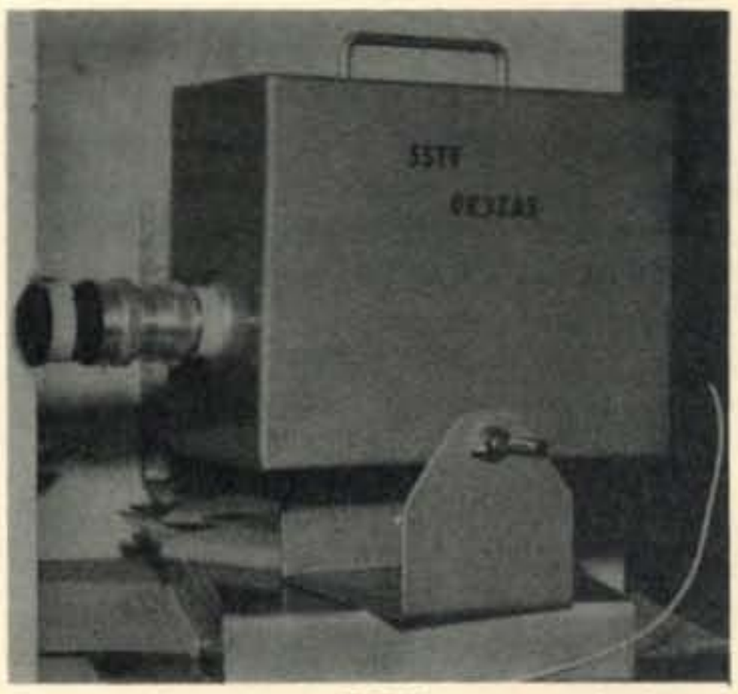


Fig. 7—Homebrew SSTV camera designed and built by OK3ZAS.

Fig. 8—OZ4IP claims this is a picture of his mobile station!

Four great ways to get the most from 10, 15 and 20 meters.

The Hy-Gain Thunderbirds. Hy-Gain Thunderbirds are mechanically and electrically superior to all other designs. They are developed on our own 35-acre, antenna test range and engineered for brilliant, DX performance on 10, 15, and 20 meters using phone or CW.

TH6DXX. This is the super Thunderbird, the undisputed 6-element king of the tri-banders. It utilizes separate Hy-Q traps with extra large coils and exceptional L/C ratios for each band. These superb Hy-Gain traps offer long term stability and exceptional band isolation. Hy-Gain traps come factory pre-tuned for peak performance and can be adjusted according to factory supplied charts for optimum results.

The TH6DXX has Hy-Gain's exclusive Beta Match for optimum matching and positive DC grounding to eliminate most precipitation static. Impedance is 50 ohms. Of the 6 elements, 3 are active on 20 and 15 meters and 4 are active on 10. VSWR is 1.5:1 at resonance and the TH6DXX is rated for maximum legal power.

All construction is of heavy gauge, taper swaged, slotted aircraft quality aluminum tubing for light weight and easy adjustment. Mechanically and electrically superior full circumference compression clamps are used throughout. The TH6DXX is supplied with a heavy duty, cast aluminum boom-to-mast bracket that accomodates masts from 1-1/4" to 2-1/2" and provides mast feed-through for antenna stacking. Extra heavy gauge, machine formed, boom-to-element brackets are used, with plastic inserts for insulation only. The high strength boom is 24', the longest in the industry.

Without a doubt, the Hy-Gain TH6DXX is the ultimate tri-band antenna, head and shoulders above all the rest. **Order No. 389**

TH3MK3. The 3-element Thunderbird, offering outstanding performance on all three bands. Lighter and smaller than the TH6DXX, yet it has Beta Match, separate traps, DC grounding, taper swaged tubing and cast mast bracket. Takes maximum legal power. **Order No. 388**

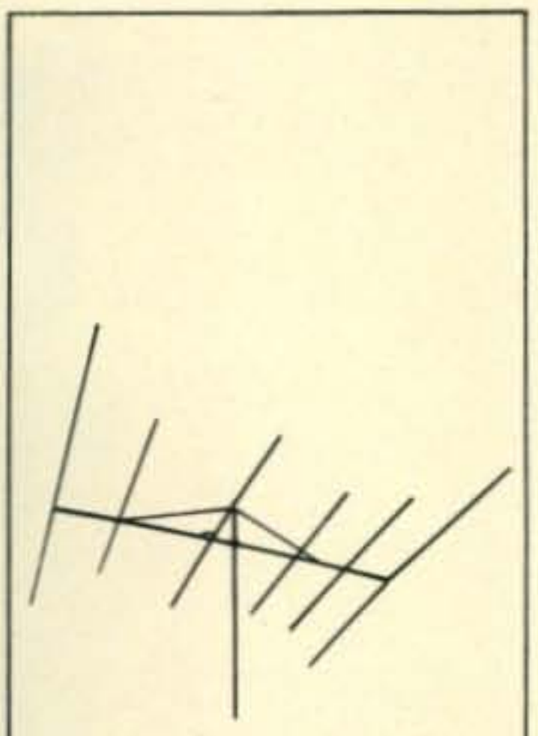
TH3JR. The Thunderbird Junior, a compact, high performance, 3-element antenna for great tri-band action in a small space. Ideal for rooftop or lightweight tower mounting. Has Beta Match, DC ground, separate traps, taper swaged tubing and a high strength formed aluminum mast bracket. Rotates with heavy duty TV rotator. **Order No. 221**

TH2MK3. This is the popular, light-weight, and low cost 2-element Thunderbird. Again, an ideal choice for cramped locations, rooftop or light tower installation. Has separate traps, Beta Match, DC ground, taper swaged tubing and a high strength, formed aluminum mast bracket. Maximum legal power rated. **Order No. 390**

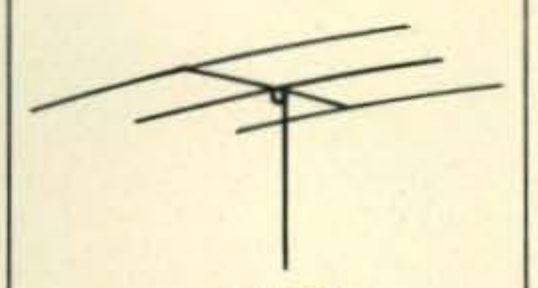
THUNDERBIRD SPECS.

Electrical	**TH6DXX**	**TH3MK3**	**TH3JR**	**TH2MK3**
Gain	8.7 dB	8 dB	8 dB	5.5 dB
Front-to-back ratio	25 dB	25 dB	25 dB	15-20 dB
Maximum power input	1 kW AM, 2 kW PEP	1 kW AM, 2 kW PEP	300 watts AM, 600 watts PEP	1 kW AM, 2 kW PEP
VSWR (at resonance)	1.5:1	Less than 2:1	Less than 2:1	Less than 2:1
Impedance	50 ohms	50 ohms	50 ohms	50 ohms
Mechanical				
Longest element	31.1'	27'	24.2'	27.3'
Boom Length	24'	14'	12'	6'
Turning radius	20'	15.7'	14.3'	14.3'
Wind load at 80 MPH	156 lbs.	103.7 lbs.	87 lbs.	96 lbs.
Maximum wind survival	100 MPH	100 MPH	80 MPH	100 MPH
Net weight	61.5 lbs.	36 lbs.	21 lbs.	22 lbs.
Mast diameter accepted	1-1/4" to 2-1/2"	1-1/4" to 2-1/2"	1-1/4" to 1-5/8"	1-5/8"
Surface area	6.1 sq. ft.	4.03 sq. ft.	3.4 sq. ft.	3.75 sq. ft.

Note: For best results, always use a Hy-Gain BN-86 Balun.

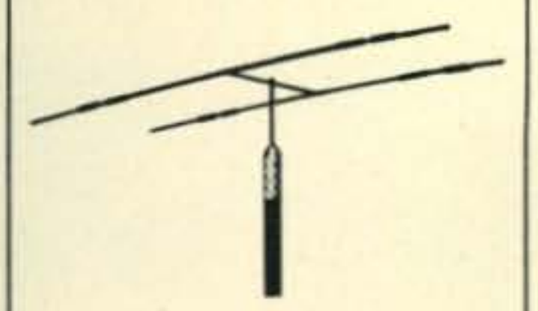


TH6DXX



TH3MK3

TH3JR



TH2MK3

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JOHN A. ATTAWAY, K4IIF, ON

DX

1976—The Bicentennial Year—is the year of the prefix chaser. The U.S.A. Bicentennial prefixes, coupled with a rash of new contest and special prefixes worldwide, has generated an enormous surge of interest in the prefix game. Last year, a normal month would yield 8-10 new applications for the WPX Award, but last month we had 19 new applicants and this month's count soared all the way to 29.

Hugh Cassidy, WA6AUD, our Assistant DX Editor, manages the WPX Awards as one of the responsibilities of his position. In a recent letter Hugh indicated that interest in WPX endorsement stickers had also increased dramatically. Over 100 DXers have applied for stickers over the 1000 prefix level which 10 years ago we considered unattainable. W4LRN is actually approaching the 1600 point and ranks as the world's prefix king.

Hugh also advises that some stations on the WPX Honor Rolls have not updated their totals recently. To keep the Honor Roll within manageable limits these calls will be dropped. Honor Roll totals should be updated at least annually, keeping in mind that Honor Roll scores may be less than total scores as inactive or discontinued prefixes can be dropped from Honor Roll eligibility at the discretion of the DX Department.

WA6AUD is also in charge of the *CQ* C.W. and S.S.B. DX Awards, and is considering whether to drop stations from those Honor Rolls who have not updated recently. Check your standings, these years sure do rush by in a hurry.

If you plan to apply for WPX or for the c.w. or s.s.b. DX Awards, or to update your Honor Roll status you can contact Hugh at the following address:

Mr. Hugh Cassidy, WA6AUD
Assistant DX Editor, *CQ Magazine*
P.O. Box 3388
San Rafael, CA 94901

Please enclose a self-addressed, stamped envelope for applications and rule sheets.

Here is the winner of 20 Meter Phone, Single Band WAZ #19, K. Takao, JA3BQE, and his lovely XYL JA3VRK. Listen for both of them on 20 and 15 meters.

The WAZ Program

Single Band WAZ

20 Meter Phone

25...JA8JN

20 Meter C.W.

10...YU1BCD

S.S.B. WAZ

1306...JA6TTO
1307...KA2AS
1308...DM2FGN
1309...JA7CDV
1310...JA7WS
1311...JA7GIF
1312...WB4OXD

C.W.-Phone WAZ

3943...WA2BRI
3944...PAØGF
3945...SP7ATA
3946...W6IUV
3947...LZITD
3948...GI5UR
3949...W5HIC
3950...LA4LE
3951...I3BCB

Phone WAZ

516...SP5XM
517...WA4EYR

Complete rules for both the Single Band and regular WAZ Programs appeared in the May, 1976 issue. Application blanks and reprints of the rules may be obtained by sending a self-addressed, stamped envelope to the DX Editor, P.O. Box 205, Winter Haven, FL 33880.

Rare Prefix News

The big story this month is the continued cooperation of DXers and licensing authorities worldwide in issuing and using new calls for the *CQ* Worldwide WPX Contest which took place the last weekend in March. Coupled with the U.S. Bicentennial prefixes, the new DX prefixes made this a very interesting contest despite the poor propagation conditions.

Brazil came through in its usual outstanding fashion with sets of ZW, ZY and ZZ prefixes corresponding to their regular PY calls. For example, ZZ6SL would be PY6SL. Similarly, Venezuelan amateurs had the option of using a YW prefix or 4M prefix in place of the usual YV. The 4M has been used heavily in past contests but YW was a newcomer to the scene and was in great demand. YV5ECY was active as YW-5ECY and had enormous pileups, as did YV5EUX operating 4M5EUX.

If you worked some of the 4J stations during the 'Test, these are special Soviet prefixes and your QSLs should go to P.O. Box 88, Moscow, the address of the Central Radio Club which handles incoming cards for the UA, UW contingent. YQ and YR prefixes were assigned for the event by the Romanian authorities and correspond to the YO calls.

Frank Sala, I2SLA, recently joined the ranks of premier world DXers when he qualified for single band WAZ #20 on twenty meter phone. Frank's regular WAZ certificate can be seen high on the wall above his Drake twins.

Left to right are Bill Wittgruber, W8QDD, and Wolfgang Homuth, OE1GHC, during Bill's visit to Vienna last year. (Photo courtesy W8QDD)

For example, YQ1AA would be YO-1AA.

Finnish amateurs activated their OG prefix series. OH1VR was very active as OG1VR. The special Equador assignment, HD in place of HC, was also widely used. One example being HD2TV by HC2TV. CT6 was Portugal's contribution to the festivities, with CT1DW active as CT6DW.

Despite the low sunspot numbers there were flashes of good propagation during the Test. Driving to the postoffice on Saturday morning, K4-IIF/mobile was able to work UK2BBB from the car which isn't bad with 100 watts to a bumper mounted vertical during contest and weekend QRM.

Those Hard to Work Zones

If you are working toward Single Band WAZ on either 40 or 80 meters, the low sunspot number can be a blessing in disguise. The maximum usable frequency is much lower than normal and DX activity is concentrated on 80 and 40 when 20 meters fades out after sundown. Rare zone 19 has been activated regularly by UAØFCE whose c.w. signals can be heard on 80 meters at 3505 kHz at the sunrise peak. Other tough zones heard around this same time and frequency include Zone 27 by DU6BG, DU6UFC, and KG6JFY and Zone 24 by VS6DO. Other 80 meter goodies are EL7F on 3806 s.s.b. around his sunrise peak at 0625 GMT for Zone 35, hard to get Zone 21 by HZ1AB on 3799 s.s.b. at 2330 GMT, Zone 36 by ZD7FT on 3794 kHz s.s.b. as 0005 GMT, Zone 32 by ZK1DX on 3799 s.s.b., and Zone 28 by 9M2DW heard on 3789 at just after sunrise. Remember, the plaque for the first Single Band WAZ Award on 80 meter c.w. is still outstanding, as is the plaque for 40 meter c.w.

And if 40 meter c.w. is your bag there have been a lot of active Zones. JTØOAQ has made it possible to snare the rarest of the rare, Zone 23, with his activity around 7002 kHz just before and after U.S. sunrise. Zone 17 has also been available thru the auspices of UA9FAG, but 0230-0300 has been the best time stateside. Other good ones on 7 MHZ c.w., with GMT times shown in parentheses are Zone 20 by SV1DO (2115) 4Z4HT (0030), and TA1ZB (0020), Zone 22 by VU2LZ(0120) and VU2DX(1240), Zone 27 by KG6JAR (0110), Zone 31 by KX6LA(1200), Zone 32 by ZL3LN/C(1230), Zone 35 by EL2FT(0205), TU2GI(2350), and 5T5ZR(0745), Zone 38 by A2ONN (0310), ZE1CU(0350), ZS1ANT(0250), and ZS6SM(0430), and Zone 39 by FR7BB(0335).

On the other hand if you've a tribander or 20 meter monobander and c.w. DXing is your bag there is a wealth of opportunity even with the poor propagation conditions. Rare Zone 18 has been activated recently by several top c.w. stations including UAØBBN and UAØBBC from Cape Chelyuskin, UAØKAH on Dickson Island, UKØSAL from Irkutsk, UK9-OAD from Novosibirsk and UK9HAC from Tomsk. These stations generally can be heard in the USA between 14030 and 14050 from 0000-0200 GMT and again between 1300 and 1400 GMT. UAØVF in the Chita region was recently copied on 21022 kHz at 1755 GMT. Zone 19 stations have not been quite so prevalent, but UKØZAF has been confirming the zone for many c.w. buffs evenings from 0130 to 0200 GMT near 14055.

Bob L. Th. Bergé, ON4QX, is one of the world's top prefix hunters and is on the WPX Honor Roll. Bob earned the first WPX Maritime Mobile and has made WAZ on phone, c.w. and s.s.b. His countries score for the CQ DX Award is 315. He has been a radio buff for 40 years and has made several DXpeditions.

We're also pleased to hear Zone 23 well represented on 14 MHz c.w. JT1AO stays busy around 14029 whenever he comes on, with 20 minutes after midnight GMT usually giving a peak signal. JT1KAA, the club station, is likewise dependable. We last heard their signal on 14038 at 0145 GMT. JT1BE has been caught on 14039 during USA morning hours 1120 GMT.

Wolfgang Homuth, OE1GHC, has been an enthusiastic participant in the CQ Awards Program for many years. He lives in downtown Vienna with a quad up 100 ft. above his building. Wolf is retired and devotes much of his time to amateur radio. (Photo courtesy W8QDD)

The CQ DX Award Program

SSB	C.W.
434...EA4LH	198...DJ6VK 199...G3JZG

Endorsements

275...DJ2AA

Complete rules and application forms for the CQ DX Awards program may be obtained by sending a business size, No. 10 envelope, self-addressed and stamped, to: "CQ DX/WPX Awards," Box 3388, San Rafael, Calif. 94902

The WPX Program

Mixed

520...VE1RQ 521...K5JBC

SSB

894...WB4TIN 897...OK2BIH
895...UA3ERD 898...K8YRV
896...OK1AGN 899...WAØLRQ
900...JA2AH

C.W.

1460...UR2CU 1467...JH6VDL
1461...UA3QAQ 1468...K5JBC
1462...UK6AAJ 1469...LZ1TD
1463...UK1QAD 1470...SP5AWV
1464...UA3CDZ 1471...SP5SIP
1465...UI8FAS 1472...SP9EEE
1466...JA1VZ 1473...OK1APS
1474...OK3EQ

WPNX

87...WNØQBT 88...WN1TVB
89...WN5MBS

VPX

103...Frank Muller DM-3367/L

Endorsements

SSB: 950 WB2NYM; 900 WB2NYM, YU1BCD; 850 WB2NYM, YU1BCD; 800 W2EHB, WA5VDH; 700 WA1KYW; 650 WA1KYW, WA2CCP; 600 WA2CCP, PA-1555; 550 WA2CEP, PA-1555; 500 WA2CCP, PA-1555; 450 WA2CCP, PA-1555; 400 PA-1555; 350 PA-1555.
CW: 950 YU1BCD; 900 WA2AIW; 800 K2AAC; 750 W5MCO; 700 VE1MF; 650 K9UIY, VK3RJ; 600 DJ3LR, UA4LM; 550 W6CLM; 500 SP6BAA; 450 SP6BAA, 400 WA4EPM.
Mixed: 1575 W4LRN; 1225 K3PVZ, W4BQY; 1200 YU1BCD; 1100 WA2EAH; 950 K2AAC; 750 W6EYY; 600 K9HLW, UY5OQ; 550 UY5OQ; 500 OK1DVK, WBØBQG; 450 K8YQW; 400 VE1RQ; 350 VE1RQ.
80 Meters: DJ3LR, W3ARK
40 Meters: DJ3LR
20 Meters: DJ3LR, UA4AY, UB5VK
15 Meters: DJ3LR, VK3RJ
Africa: W2EHB
Europe: UA4AY, WA2CCP, HE-9ILN, K3EH
North America: VE1MF, WA2CCP, WA4EPM, HE-9ILN, K3EH
Oceania: VK3RJ

Complete rules for WPX may be found in the May, 1976 issue of *CQ* Magazine. Application forms may be obtained by sending a business size envelope, self-addressed and stamped, to "CQ DX/WPX Awards," Box 3388, San Rafael, Calif. 94902

Other goodies on 20 c.w. are BV2A and VS6BL, representing Zone 24, and Zone 24 representatives 4S7NE and 4S7DA. The latter is Awards Committee Chairman for the Radio Society of Ceylon and checks cards for *CQ* awards in that part of the world.

S.s.b. Zone hunters can find sustenance in the Zone 23 activity of UA9VH/JT1 evenings near 14230, and dependable ST2SA, 14206 at 2000 GMT from Zone 34. There has been a lot of help also with Zone 18 where UKØSAJ in Irkutsk and UKØBAH on Dickson Island have passed out many contacts in early evening and early morning hours along the U.S. east coast, and Zone 19 activity has been even more prevalent on s.s.b. than on c.w. UAØFCK, UKØFAJ and UVØEX have all been on from Sakhalin Island and UWØMF from Ussuriisk.

Additional s.s.b. activity from hard Zones has included VS6BL, VS6EG, VS6DO, VS6DR and CR9AJ from Zone 24, VU2GDG, VU2GGT, VU2DK, and VU7ANI from Zone 22 plus a number of YB, 9M2 and 9VI stations from Zone 28. Zone 24 has been peaking at about 1230-1300 GMT and Zone 22 at times between 1500 and 1730 GMT depending on your location.

George McClarey, EI6S, of County Cavan, Ireland is one of the "emerald isle's" top DXers, recently qualifying for CQ's WAZ award using Drake Line equipment. Bob is a tractor and machinery specialist.

Tony, M1C, took part in the first activity via satellite, Oscar 6 and 7, from San Marino with I5TDJ and M1I. (Photo via Ed, W3JZJ)

De Extra

Those S.A.S.E.'s. They're Very Important: Riding along "copying the

The WPX HONOR ROLL

The WPX Honor Roll is based on confirmed *current* prefixes, which are submitted by separate application in strict conformance with the CQ Master Prefix List. Scores are based on the current prefix total, regardless of an operators all-time prefix count.

Mixed

W4LRN	1575	DJ7CX	1157	I6SF	946	W6ISQ	847	WØSFU	750
WA6MWG	1378	PAØSNG	1146	DL1MD	940	WAØKDI	824	CT1LN	749
W6TCQ	1325	WA2EAH	1100	WØAUB	929	W6NJU	811	WA5LOB	749
F9RM	1283	WB4KZG	1100	K2AAC	913	W9WHM	811	PY4AP	735
W2NUT	1258	ON4QX	1088	WB4SIJ	910	W9ZTD	807	KØBLT	733
W9DWQ	1253	WA6GLD	1075	SM6TV	905	WA1JMP	806	K7NHG	719
W4CRW	1251	W3GJY	1052	YU2OB	881	WA6TAX	805	WA6EPQ	713
VE3GCO	1233	W9FD	1035	W4WSF	877	IØJX	803	PAØVB	706
W3PVZ	1231	WA5VDH	1025	WA6JVD	875	SM6DHU	803	WAØCPX	693
W8LY	1220	YU2DX	995	DL1CF	872	K6ZDL	802		
W4BQY	1188	YU1AG	992	W3YHR	861	IT9AGA	791		
W8ROC	1181	K6SDR	977	K4KQB	853	K2ZRO	782		
WB2FMK	1180	W4IC	950	G3DO	849	K8UDJ	750		

SSB

W4NJF	1331	HP1JC	954	WØYDB	884	W3DJZ	818	OK1MP	763
F9RM	1223	I4ZSQ	952	K2POA	883	PY3BXW	808	YU1AG	752
IØAMU	1156	WB2NYM	941	ZL3NS	874	WB4SIJ	803	W2EHB	750
W6TCQ	1155	YU1BCD	940	DL1MD	858	W4IC	800	WA5LOB	747
W9DWQ	1011	CT1PK	923	WA6TAX	855	WB4KZG	800	W6YMV	720
WA6MWG	1090	PAØSNG	908	WA2EAH	850	DJ7CX	800	CX2CN	702
IØZV	1067	DK2BI	907	W3YHR	836	WA5VDH	790	WB2FMK	659
I8KDB	1058	F2MO	904	IT9JT	833	OE2EGL	780	I4LCK	608
DL9OH	954	I8YRK	900	W6RKP	822	G3DO	765		

C.W.

W8LY	1205	W6TCQ	931	K7ABV	812	WA2HZR	732	K2ZRO	649
W8KPL	1203	I4ZSQ	922	VK3AHQ	809	I6SF	726	K1LWI	629
WB2FMK	1040	ON4QX	920	WA6JVD	803	SM5BNX	706	VE4OX	600
WA6MWG	1039	W3ARK	910	YU1AG	796	WA2EAH	700	OK2QX	600
DL1QT	1030	G2GM	890	K2AAC	776	VO1KE	700		
W2AIW	972	DJ7CX	887	WA5VDH	772	K6ZDL	699		
YU1BCD	962	W2HO	885	W4BYU	768	OK2DB	693		
W9FD	944	VO1AW	873	W4IC	754	W6ISQ	685		

Prefix hunters will find this map illustrating the Hungarian call areas of interest. The second letter from the end of the call sign indicates the region within a call area, for example, HA2KRB and HG2-RD are in the Veszprem region. The cities shown are regional centres. (Photo via G2BVN)

mail" recently on 20 meter s.s.b., K4IIF/Mobile has the opportunity to listen to a long discourse by a U.S. amateur offended because a DX station had requested a self-addressed, stamped envelope (s.a.s.e.) as a prerequisite to a QSL card. The complainer felt that in the great brotherhood (and sisterhood) of amateur radio, each of us were equal participants and the DX station should be just as happy to receive his beautiful, 3-color QSL as he was to receive the DX QSL.

Despite the occasional bickering over who called CQ right on top of whose QSO, De Extra agrees that amateur radio is a foremost international brotherhood of equal participants. Except in a few extreme cases it transcends doctrine, politics, social or economic position or any other pecking order. Over the air the private may be on a first name basis with a general or the lab technician with the chairman of the board of his company. However, there are certain simple practicalities which one must recognize and accept, and if you're going to play the DX game the *s.a.s.e.* is one of them. Without it, stations in rare countries simply couldn't afford the time and expense to send QSL cards. Neither could their QSL Managers in most cases. Considering the amount of work involved just in making out the cards, I'm delighted that the rare stations will QSL even upon receipt of an *s.a.s.e.*

Let's cite a simple example of a station close to home who even has the benefit of the same postal system. The Virgin Islands are not dreadfully rare as DX countries go, but because of the new bicentennial prefixes our old friend Dick Spenceley, KV4AA, is swamped with requests for his new AJ3AA card. As of April 7, just over a third of the way through the year, Dick had made 7,700 contacts using his AJ3 call. By the end of the year he will receive at a bare minimum 10,000 QSL cards from amateurs all over the world who will want an AJ3 card. If he mailed this many cards at the 9¢ postcard rate his bill for postage alone would be $900, to say nothing of printing costs and the enormous amount of time to check the logs and *address* the cards. Of course if he put each card in an envelope he would have to buy 10,000 envelopes and pay $1300. postage.

Unfortunately this is just the "simple" job of answering U.S. requests. Supposing a few thousand of them are from overseas amateurs, the postage costs then become absolutely astronomical. Postcards and letters sent the slow route by ship would be 12c and 18c respectively. By air they would be 21¢ and up to 31¢, respectively. Obviously Dick would have to send his cards to the Bureaus, but did you know that there are almost 150 QSL Bureaus in the world today.

By this time it is pretty obvious that the DX station and the home station, while equal as amateurs are very unequal in the magnitude of their QSL choses. Over the years K4IIF has used several nice cards but there has never been a deluge of folks insisting they had to have one up on their wall. I for one am very thankful that there are amateurs in the world who will take the time and effort to lookup my contact in the log and send me a card if I will just send them an addressed and stamped envelope to use in mailing it to me. Always send an *s.a.s.e.* to rare DX stations or to their QSL Managers. Its the easiest way of saying thanks to those guys and gals for just being there when you need them.

Hans, DL6TQ, recently qualified for WAZ using only a vertical and a dipole. He indicates that there is a beam in his future. Hans started in amateur radio in 1936, but "due to well known interruptive circumstances" was off the air for the years prior to 1951. He is age 57, a patent attorney by profession and a member of FOC, TOPS and HSC.

JOURNEE MONDIALE DES TELECOMMUNICATIONS — 17 MAI
WORLD TELECOMMUNICATION DAY — 17 MAY
DIA MUNDIAL DE TELECOMUNICACIONES — 17 DE MAYO

Anniversaire de la fondation à Paris en 1865 de l'Union internationale des télécommunications
Anniversary of the founding at Paris in 1865 of the International Telecommunication Union
Aniversario de la fundación en Paris en 1865 de la Unión Internacional de Telecomunicaciones

N 3 I T U

DATE/FECHA	TU/UT	RADIO	RST	MHz.	A1	A3J	

W3DOS / DEPARTMENT OF STATE AMATEUR RADIO CLUB Washington, D. C. 20520 USA

73, ... Op.

The Department of State Amateur Radio Club is using the above QSL to celebrate World Telecommunication Day, May 17, 1976 with an operation as N3ITU from May 1-May 31. QSL to W3DOS. (Photo courtesy K3KWJ)

QSL Information

A2CAB—Via WA2LOR
A6XN—To DJ9ZB
A6XP—c/o DK3NK
A35NN—Via Bill Rindone, WB7ABK, 3049 Doris Ct., Lake Oswego, OR 97034
A51PN—For QSO's up to Sept. 1, 1974, QSL to W1JFL.
AH3DV/AG2—c/o KS6DV
C9MJO—Via W8CNL
C21NI—To YASME Foundation, P.O. Box 2025, Castro Valley, CA 94546
C31ME—c/o W1YRC
DK6NJ/HB0—Via DK6NJ
DJ6IP/HB0—To WA4ZSB
D2ASW—c/o K4UTE
DU6BG—Via WA7RFH
EL8O—To OE6WMG
FG7AR/FS7—c/o K1LPA
FG0BKZ—Via F6BBJ
FK8BG—To W7OK for contacts *after* Jan. 1, 1976
FK0KG—c/o YASME Foundation, P.O. Box 2025, Castro Valley, CA 94546
FP8DX—Via K9OTB
FY7AN—To WB4VUP
HZ1AB—c/o DJ9BZ or WA6AHF
JX3WU—Via P.O. Box 3101, Bergen N5009, Norway
JX4GN—To LA4GN
JX6DS—c/o I2CBM
JY9EK—Via WA5LMG
KG6JBX—To KH6IDL
KG6SW—c/o W7YBX
KM6CV—Via WA6ZMN
LH2A—To LA2AD
LU1XY—c/o Juan Cortez, Communications Base Aeronaval, Ushuaia, Argentina
PJ8CO—Via W1YE

(Continued on page 74)

FIRST

Make this comparison:

The GTX-1 gives the high quality performance that compares with Motorola, GE, RCA or any other hand-helds that sell for $700 or more.

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Small: only 8"x2.6"x1.28" . . . **Appearance:** slim silhouette all black metal . . . **Serviceable:** easy access to separate receive and transmit circuit boards . . . **PLUS:** 6 pole xtal filter for superlative receiver operation . . . **and:** trimmers on receive and transmit xtals: standard 10.7 MHz 1st IF.

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☐ **Lambda/4 2-M and 6-M Trunk Antenna** @ $29.95 $_____

☐ **TE-I Tone Encoder Pad** for plug-in installation on most amateur transceivers @ $59.95 $_____

☐ **TE-II Tone Encoder Pad** for installation on most Hand-Helds @ $49.95 $_____

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CB 576

CLIP OUT AND ORDER NOW CLIP OUT AND ORDER NOW

Contest Calendar

BY FRANK ANZALONE, W1WY

The success of a QSO Party in no small way depends on picking a good week-end. Scheduling it on the same dates used by a major contest however can hardly be considered good planning, as was the case with this year's Tennessee QSO Party.

Advising them that the week-end they picked was the same one used by the CQ WPX SSB Contest got the response, "it was the only open date in March." This didn't make much sense since we have had the WPX Contest on the last week-end in March for some years now.

Then it dawned on me that the poor chap who planned the event probably only reads that one magazine. And we all know that *QST* never lists *CQ Contests.* (Correction, lately they have listed our World Wide contest in the Fall.)

Moral of the story, check other publications to get a complete picture of contest schedules.

As an added suggestion, *QST* would better serve the contest minded fraternity by listing all major events.

I don't know how the Tennessee boys made out but we had a good one in spite of below normal propagation.

How about those conniving characters at the home office. (Page 63 April issue) I never know what to expect come April each year. Dick conned me into taking all those snapshots on the pretense that he wanted an update image to head the Column. Well now he's got 12 of them. There's one consolation, now that they have booted him upstairs, I have only Al to contend with. (I'm only kidding fellows, congratulations to both of you.)

73 for now, Frank, W1WY

Calendar of Events

* June	5	6 Meter "SMIRK" Party
* June	5-6	SOWP Bicentennial C.W.
* June	5-6	Minnesota QSO Party
* June	4-7	CHC/FHC/HTH Party
June	12-13	ARRL VHF QSO Party
* June	12-13	RSGB National Field Day
* June	12-14	West Virginia QSO Party
† June	19-20	All Asian Phone Contest
June	26-27	ARRL Field Day
July	3-4	QRP Activity Contest
* July	3-4	Venezuelan Phone Contest
* July	3-25	Space Net VHF Contest
July	17-19	County Hunters C.W.
† July	17-18	Colombian Contest
July	24-25	ARRL Bicentennial
July 31-Aug.	-1	Venezuelan C.W. Contest
July 31-Aug.	-1	Illinois QSO Party
Aug.	7-8	10-10 Net Summer QSO Party
Aug.	14-15	European C.W. Contest
Aug.	21-22	Big 15 QSO Party
† Aug.	21-22	All Asian C.W. Contest
Aug.	21-23	New Jersey QSO Party
Aug.	21-23	QRP ARCI Contest
Sept.	11-12	European Phone Contest
Sept.	18-19	Scandinavian C.W. Contest
Sept.	25-26	Scandinavian Phone Contest
Sept.	25-27	Delta QSO Party

* Covered in last month's Calendar
† Not official

QRP Activity C.W. Contest

Starts: 1500 GMT Saturday, July 3
Ends: 1500 GMT Sunday, July 4

The DL Activity Group runs two of these QRP contests each year, in January and July.

Power input is limited to 10 watts or less, single operator and c.w. only. QRO stations may participate but only contacts with QRP staions are valid. Limit your operating to 15 hours. The 9 hours of rest may be taken in two parts. Contacts may be made on any five bands in the 1.8-28 MHz group.

Exchange: RST plus QSO no. and power input. Add "x" if crystal controlled. (579001/8x) Stations using more than 10 watts indicate QRO instead of power number.

Scoring: Contacts with stations in same country 1 point, other countries same continent 2 points. DX on other continents 3 points. If QSO is with another QRP station add 3 more points. (4 to 6 pts. possible) Stations using 3.5 watts or less get credit for 1 handicap point, another handicap point if rig is crystal controlled. Double the above if both stations meet above handicap requirements. (8 to 12 final points possible).

(That's the way I figure it. Much too complicated, should be simplified. Ed.)

Multiplier: Each DXCC country worked, 1 if on own continent, 2 if on another continent. Plus call areas of JA, PY, VE, VK, W/K and ZS.

Final Score: Total QSO points times the multiplier from each band. (Scoring for QRO stations same)

Include a summary sheet showing the scoring and equipment description, and the usual signed declaration.

Mailing deadline is July 31st to: Hartmut Weber, DJ7ST, D-3201 Holle, Kleine Ohe 5, West Germany.

County Hunters C.W. Contest

Starts: 0000 GMT Saturday, July 17
Ends: 0600 GMT Monday, July 19

The County Hunters Net encourages and invites mobile and portable operation from the less active counties during this contest.

The same station may be worked on each band for QSO points. Portable and mobiles changing counties may also have repeat QSOs. Stations on county lines exchange only one number but each county is counted as a multiplier.

Exchange: QSO no., category, (F—fixed, P—portable, M—mobile) RST, state, province or country, and county for US stations.

Scoring: QSO's with a fixed station 1 point, 3 points if its a portable or mobile. Multiply total QSO points by number of US counties worked. Mobile and portables calculate their score for contacts made within a state.

Frequencies: 3575, 7055, 14070, 21070, 28070.

Awards: Certificates in three categories.

F — Top fixed or fixed portable in each state, province or country, 1000 or more points.

P — Top score in each state by a portable operating from a county other than its normal location, 1000 or more points.

M — Top scoring mobile in each state operating from 3 or more counties, with a minimum of 15 QSOs from each county.

There are Trophies for the Top single operator Portable and Mobile in the United States.

Stations with 100 or more QSOs *must* include a check sheet of counties worked.

Mailing deadline is Sept. 1st to: C.W. County Hunters Net, c/o Jeffrey P. Bechner, W9MSE, 673 Bruce Street, Fond de Lac, Wisc. 54935.

Colombian Contest

Starts: 0001 GMT Saturday, July 17
Ends: 2359 GMT Sunday, July 18

This year's contest commemorates the 166th Anniversary of Colombia's Independence. Exchange will be on a world wide basis.

All bands, 3.5 thru 28 MHz, phone and c.w. Three classes, single operator, single band and all band; multi-operator single transmitter.

Exchange: RS(T) plus a 3 figure QSO number starting with 001.

Scoring: QSOs with HK's 5 points, with stations in North America 3 points, other countries 2 points, and with same country 1 point. The multiplier is determined by the sum of DX countries worked on each band.

Final Score: Sum of QSO points from all bands multiplied by the sum of different countries worked on each band.

Awards: A silver cup to the world winner. There are nine plaques, six to the continental winners and three to the top scoring station in each category. Certificates will be issued to the top scoring station in each country.

A minimum of 50 QSOs must be shown by all awards winners.

Use a separate log sheet for each band, indicate the country only the first time it is worked and include a summary sheet showing the scoring, a signed declaration and etc. The usual rules of disqualification will be observed.

Mailing deadline is September 30th to: L.C.R.A. Concurso Independencia, Apartado Postal 584, Bogota, Colombia.

ARRL Bi-Centennial Celebration

Starts: 0000 GMT Saturday, July 24
Ends: 2359 GMT Sunday, July 25

This is a one time only activity which offers an excellent opportunity to complete your ARRL WAS Bicentennial and also the *CQ* "USA WPX '76" Award.

Amateurs in the 50 U.S. states will work stations outside the country as well as other U.S. amateurs. Out-of-country amateurs will work only stations in the 50 U.S. states.

Any mode or band may be used, however operating time is limited to 36 out of the 48 hour activity period. Limit your "time-outs" to eight with a minimum of at least 15 minutes.

Classification: Single operator only for U.S. entries. Single operator and multi-operator for others, but no multi transmitter.

Exchange: Signal report, state and state entry number into the Union. (see list in *QST*) Non-U.S. stations, signal report and QSO serial number starting with 001.

Scoring: Total number of contacts is your final score, there is no multiplier.

Awards: There are several awards, making 1776 QSOs, 200 QSOs, 50 QSOs on 50 MHz and above, WAS, section high, country high and a few others.

Better check March issue of *QST* for more details. Special summary and log sheets are available by sending a request and s.a.s.e. to ARRL.

Entries must be postmarked no later than September 1st to: ARRL Bicentennial Celebration, Newington, Conn. 06111.

Illinois QSO Party

Two Periods (GMT)
1800 Sat. July 31 to 0500 Sun. Aug. 1
1200 Sun. Aug. 1 to 2300 Sun. Aug. 1

This is the 14th annual party sponsored by the Radio Amateur Megacycle Society. The same station may be worked on each band and mode. Ill. stations may work other in-state stations.

Exchange: RS(T) and QTH. County for Ill., state, province or country for others.

Scoring: *For Illinois:* Total QSOs × (Ill. counties + states + VE provinces + DXCC countries) *For all others:* Total Ill. QSOs × Ill. counties worked. (max. of 102)

Ill. mobiles add 200 to score for each county operation from which 10 or more contacts were made. For non-Ill. stations there is a bonus multiplier of one for each group of 8 contacts with the same county.

Look for K9CJU/9 operating from *USS Silversides,* famed WW II submarine, each contact worth 5 points.

Frequencies: 60 kHz from low end of each c.w. band. 25 kHz from high end of each phone band. (also 21375 and 28675) And 25 kHz from low end of Novice bands on the half hour.

Awards: Certificates to the top stations in each category in each state, VE province, DX country and first 3 places in Illinois. Categories: single operator, multi-operator, mobile and Novice entries.

Mailing deadline is Sept. 15th to: RAMA, K9CJU, 3620 N. Oleander Ave., Chicago, Ill. 60634. Include large s.a.s.e. for results.

Ten-Ten Net QSO Party

Starts: 0000 GMT Saturday, August 7
Ends: 2400 GMT Sunday, August 8

This is the summer edition of the Ten-Ten International Net of Southern California QSO Party. Activity is on 10 meters only but using any mode. Its open to all amateurs but non-members are not eligible for awards. They are however encouraged to submit a list of stations worked and apply for membership.

Exchange: Name, QTH and 10-10 membership number for Net members.

Scoring: Score 1 point per contact, add an additional point if its with a 10-10 member. (max. of 2 points) Total QSO points is your score, there is no multiplier. Indicate name of your chapter on your log.

Awards: 1st and 2nd place certificates in each U.S. call area, KH6, KL7, and each VE province. And to 11 continental and sub-continental areas over the world.

Mailing deadline for logs is Sept. 30th to: Grace Dunlap, K5MRU/Ø, P.O. Box 13, Rand, Colo. 80473

European DX Contest

C.W.: Aug. 14-15
Phone: Sept.: 11-12
Starts: 0000 GMT Saturday
Ends: 2400 GMT Sunday

This is the 22nd annual contest sponsored by the DARC. The activity will be between the European countries and the rest of the world.

Use all bands 3.5 thru 28 MHz. There are two classes, Single operator, All Band, and Multi-operator, Single Transmitter.

Only 36 hours out of the 48 hour contest period may be used by single operator stations. The 12 hour rest period may be taken in one but not more than three periods any time in the contest.

Exchange: RS(T) plus a QSO number starting with 001.

(Continued on page 74)

GEORGE JACOBS, W3ASK, ON

Propagation

The Swiss Federal Observatory at Zurich reports a mean sunspot number of 23 for March, 1976. Solar activity varied considerably during the month, ranging from a low to zero between March 1st and 5th, to a high of 51 on the 19th and 20th.

Solar activity during March resulted in a smoothed sunspot number of 14.5, centered on September, 1975. The cycle is expected to continue its very slow decline towards a minimum value, and a smoothed sunspot number of approximately 7 is forecast for June.

June Propagation

Twenty meters looks like it should be the best band for DX propagation during June. Expect it to open just after sunrise, and to remain open for a few hours in almost all directions. When conditions are LOW NORMAL or better, chances are good for openings to Europe, Central and South America, the South Pacific, Australasia and the Far East, before noontime absorption sets in. A second, and usually stronger peak is expected during the late afternoon, when good openings should be possible towards Europe, Africa, Central and South America and the Middle East. After sunset, and until Midnight, look for good openings to South America, Antarctica, the South Pacific, Australasia and the Far East. When conditions are HIGH NORMAL or better, there may also be post-sundown openings on *20* meters to Europe, Africa and the Middle East.

Not too much DX expected on *15* meters this month, but some should be possible. When conditions are at least LOW NORMAL, expect fairly good openings towards Central and South America as early as 9 a.m. Best time for these openings, however, should be during the afternoon hours and possibly as late as the sundown period. The band may also open occasionally from the eastern half of the United States towards Africa, and from the western half towards the South Pacific, Australasia and the Far East. Best time to check for these openings are during the afternoon hours, especially when conditions are HIGH NORMAL, or better.

Few, if any DX openings are expected on *10* meters, except to those areas of the Caribbean and Central America within a 1300-mile range of short-skip sporadic-E openings from the USA. An occasional longer opening into South America may be possible during the late afternoon hours, when conditions are HIGH NORMAL, or better.

Longer hours of daylight and seasonally higher levels of static should reduce considerably the chances for DX openings on *40, 80* and *160* meters. Some fairly good openings, however, are forecast to several areas of the world for *40* meters during the hours of darkness and the sunrise period. Somewhat fewer, but often good openings should also be possible on *80* meters during much of the same time period.

Plenty of good short-skip openings are expected on the h.f. bands during June. For distances less than 250 miles try *80* meters during the day, *160* meters at night. For openings between 250 and 750 miles, *40* meters should be best during the day and *80* meters at night. For openings beyond 750 miles, *20* meters should be optimum during the day and *40* meters at night. Frequent short-skip, sporadic-E type openings are also expected on *10* and *15* meters over distances between approximately 600 and 1300 miles.

V.H.F. Ionospheric Openings

Expect a considerable increase in sporadic-E propagation during June and the summer months. This should result in fairly frequent 6 meter openings over a range of approximately 1000 to 1400 miles. During periods of geographically widespread ionization, two-hop *6* meter openings may occasionally be possible up to about 2300 miles. An occasional *2* meter short-skip opening, between approximately 1200 and 1400 miles, may also be possible during periods of intense sporadic-E ionization. Short-skip openings are most likely to occur between 10 a.m. and 2 p.m. and again between 6 and 10 p.m., local daylight time, although they can occur at other times as well.

Look for some meteor activity between June 7 and 9, which could increase the possibility for meteor-scatter type openings on the vhf bands.

Check the "Last Minute Forecast"

LAST MINUTE FORECAST—JUNE

Day-to-Day Conditions Expected For June 1976

	Expected Signal Quality			
Propagation Index	(4)	(3)	(2)	(1)
Date				
Above Normal: 9, 13	A	A	B	C
High Normal: 8, 10-12	B	B	C	D
Low Normal: 3-7, 14, 18-19, 25-27, 29-30	B	C	D	E
Below Normal: 1-2, 15, 17, 20, 22-24, 28	C	D	E	E
Disturbed: 16, 21	D-E	E	E	E

Where *expected signal quality is:*

A—Excellent opening, exceptionally strong, steady signals greater than S9+30 dB.

B—Good opening, moderately strong signals varying between S9 and S9+30 dB, with little fading or noise.

C—Fair opening, signals between moderately strong and weak, varying between S3 and S9, with some fading and noise.

D—Poor opening, with weak signals varying between S1 and S3, and with considerable fading and noise.

E—No opening expected.

HOW TO USE THIS FORECAST

1. Find *propagation index* associated with particular band opening from Propagation Charts appearing on the following pages.
2. With the *propagation index*, use the above table to find the expected signal quality associated with the band opening for any day of the month. For example, a path shown in the Charts with a propagation index of (3) will open *poorly* on June 1-2; will be *fair* on June 3-7, (C) and *good* on June 8 (B), etc.

For updated information dial Area Code 516-883-6223 for DIAL-A-PROP, subscribe to bi-weekly MAIL-A-PROP, P.O. Box 86, Northport, NY 11768, or check WWV at 14 minutes past each hour.

at the beginning of this column for those days during June that are expected to be BELOW NORMAL or DISTURBED on the h.f. bands. These are the days on which auroral and other types of ionospheric propagation may be possible on the vhf bands.

This month's *CQ* Propagation Charts contain DX predictions for the period June 15 through August 15, 1976. Short-Skip Charts for June, for openings between 50 and 2300 miles, and from Hawaii and Alaska, appeared in last month's column.

73, George, W3ASK

June 15-August 15, 1976
Time Zone: EDT (24-Hour Time)
EASTERN USA TO:

	15 Meters	*20 Meters*	*40 Meters*	*80 Meters*
Western & Central Europe & North Africa	13-18 (1)	06-07 (1) 07-09 (2) 09-14 (1) 14-16 (2) 16-17 (3) 17-18 (4) 18-19 (3) 19-20 (2) 20-22 (1)	19-21 (1) 21-22 (2) 22-00 (3) 00-01 (2) 01-02 (1)	21-22 (1) 22-00 (2) 00-01 (1) 22-00 (1)*
Northern Europe & European USSR	*Nil*	06-07 (1) 07-09 (2) 09-15 (1) 15-18 (2) 18-19 (3) 19-22 (2) 22-00 (1)	20-21 (1) 21-23 (2) 23-00 (1)	21-23 (1)
Eastern Mediterranean & Middle East	11-13 (1) 16-17 (1)	13-15 (1) 15-17 (2) 17-19 (3) 19-20 (2) 20-22 (1) 22-00 (2) 00-06 (1) 06-08 (2) 08-09 (1)	20-22 (1) 22-00 (2) 00-01 (1)	22-00 (1)
Western Africa	11-14 (1) 14-17 (2) 17-18 (1)	05-06 (1) 06-07 (2) 07-15 (1) 15-17 (2) 17-18 (3) 18-20 (4) 20-21 (3) 21-23 (2) 23-01 (1)	20-22 (1) 22-01 (2) 01-02 (1)	21-01 (1)
Eastern & Central Africa	11-16 (1)	16-18 (1) 18-20 (2) 20-21 (1)	22-00 (1)	22-00 (1)
Southern Africa	11-13 (1)	01-03 (1) 05-07 (1) 15-16 (1) 16-18 (2) 18-19 (1)	20-21 (1) 21-01 (2) 01-02 (1)	22-01 (1)* 23-01 (1)*
Central & South Asia	*Nil*	07-10 (1) 20-23 (1)	05-07 (1) 20-22 (1)	*Nil*
Southeast Asia	*Nil*	07-10 (1) 19-23 (1)	*Nil*	*Nil*
Far East	*Nil*	07-08 (1) 08-10 (2) 10-12 (1) 20-23 (1)	04-06 (1)	*Nil*
South Pacific & New Zealand	19-22 (1)	19-21 (1) 21-01 (2) 01-07 (1) 07-10 (2) 10-12 (1)	02-03 (1) 03-06 (2) 06-07 (1)	03-06 (1) 03-05 (1)*
Australasia	19-22 (1)	06-08 (1) 08-09 (2) 09-12 (1) 17-19 (1) 21-23 (1) 23-01 (2) 01-04 (1)	03-04 (1) 04-06 (2) 06-07 (1)	03-06 (1)
Caribbean, Central America & Northern Countries of South America	15-17 (1)** 09-12 (1) 12-15 (2) 15-18 (3) 18-20 (2) 20-21 (1)	06-07 (1) 07-08 (2) 08-10 (4) 10-12 (3) 12-16 (2) 16-18 (3) 18-21 (4) 21-23 (3) 23-00 (2) 00-02 (1)	20-22 (1) 22-23 (2) 23-03 (3) 03-05 (2) 05-07 (1)	22-00 (1) 00-04 (2) 04-06 (1) 02-05 (1)*
Peru, Bolivia, Paraguay, Brazil, Chile, Argentina & Uruguay	14-17 (1)** 09-12 (1) 12-15 (2) 15-17 (3) 17-19 (2) 19-20 (1)	06-08 (1) 08-09 (2) 09-15 (1) 15-17 (2) 17-19 (3) 19-20 (4) 20-22 (3) 22-00 (2) 00-04 (1)	21-23 (1) 23-03 (2) 03-06 (1)	00-05 (1) 01-04 (1)*
McMurdo Sound, Antarctica	*Nil*	20-22 (1) 22-00 (2) 00-02 (1)	00-03 (1) 03-06 (2) 06-07 (1)	03-06 (1)

June 15-August 15, 1976
Time Zones: CDT & MDT
(24-Hour Time)
CENTRAL USA TO:

	15 Meters	*20 Meters*	*40 Meters*	*80 Meters*
Western & Southern Europe & North Africa	13-17 (1)	06-07 (1) 07-09 (2) 09-14 (1) 14-16 (2) 16-18 (3) 18-19 (2) 19-21 (1)	20-22 (1) 22-00 (2) 00-02 (1)	21-00 (1)
Northern Europe & European USSR	*Nil*	06-07 (1) 07-09 (2) 09-14 (1) 14-17 (2) 17-20 (1) 20-22 (2) 22-23 (1)	20-23 (1)	21-23 (1)
Eastern Mediterranean & Middle East	*Nil*	07-09 (1) 14-15 (1) 15-17 (2) 17-19 (1) 19-21 (2) 21-22 (1)	20-23 (1)	*Nil*
Western Africa	14-16 (1)	06-08 (1) 13-15 (1) 15-17 (2) 17-18 (3) 18-19 (2) 19-21 (1)	20-00 (1)	21-23 (1)
Eastern & Central Africa	*Nil*	16-18 (1) 18-20 (2) 20-21 (1)	20-23 (1)	*Nil*

*Indicates best time for 160 Meter opening.
**Indicates best time for 10 Meter opening.

HOW TO USE THE DX PROPAGATION CHARTS

1. Use Chart appropriate to your transmitter location. The Eastern USA Chart can be used in the 1, 2, 3, 4, 8, KP4, KG4 and KV4 areas in the USA and adjacent call areas in Canada; the Central USA Chart in the 5, 9 and 0 areas; the Western USA Chart in the 6 and 7 areas, and with somewhat less accuracy in the KH6 and KL7 areas.

2. The predicted times of openings are found under the appropriate meter band column (15 through 80 Meters) for a particular DX region, as shown in the left hand column of the Charts. A ** indicates the best time to listen for 10 meter openings; * best times for 160 meter openings.

3. The *propagation index* is the number that appears in ( ) after the time of each predicted opening. The index indicates the number of *days* during the month on which the opening is expected to take place as follows:
(4) Opening should occur on more than 22 days
(3) Opening should occur between 14 and 22 days
(2) Opening should occur between 7 and 13 days
(1) Opening should occur on less than 7 days
Refer to the "Last Minute Forecast" at the beginning of this Propagation column for the actual *dates* on which an opening with a specific propagation index is likely to occur, and the signal quality that can be expected.

4. Time shown in the Charts are in the 24-hour system, where 00 is midnight; 12 is noon; 01 is 1 A.M., 13 is 1 p.m., etc. Appropriate *daylight* time is used, *not GMT*. To convert to GMT, add to the times shown in the appropriate chart 7 hours in PDT Zone, 6 hours in MDT Zone, 5 hours in CDT Zone, and 4 hours in EDT Zone. For example, 14 hours in Washington, D.C. is 18 GMT. When it is 20 hours in Los Angeles, it is 03 GMT, etc.

5. The charts are based upon a transmitter power of 250 watts c.w., or 1 kw, p.e.p. on sideband, into a dipole antenna a quarter-wavelength above ground on 160 and 80 meters, a half-wave above ground on 40 and 20 meters, and a wavelength above ground on 15 and 10 meters. For each 10 db gain above these reference levels, the *propagation index* will increase by one level: for each 10 db loss, it will lower by one level.

6. Propagation data, contained in the Charts has been prepared from basic data published by the Institute For Telecommunication Sciences of the U.S. Dept. of Commerce, Boulder, Colorado, 80302.

	15 Meters	*20 Meters*	*40 Meters*	*80 Meters*
Southern Africa	10-12 (1)	05-07 (1) 14-15 (1) 15-17 (2) 17-18 (1) 22-00 (1)	21-23 (1) 23-00 (2) 00-01 (1)	22-00 (1)
Central & South Asia	*Nil*	09-11 (1) 18-20 (1) 20-22 (2) 22-00 (1)	05-07 (1) 19-21 (1)	*Nil*
Southeast Asia	19-21 (1)	08-10 (1) 20-21 (1) 21-23 (2) 23-00 (1)	05-07 (1)	*Nil*
Far East	20-22 (1)	07-08 (1) 08-11 (2) 11-21 (1) 21-23 (2) 23-01 (1)	04-07 (1)	04-06 (1)
South Pacific & New Zealand	15-19 (1) 19-21 (2) 21-22 (1)	17-19 (1) 19-22 (2) 22-00 (3) 00-02 (2) 02-07 (1) 07-10 (2) 10-14 (1)	01-03 (1) 03-04 (2) 04-06 (3) 06-07 (2) 07-08 (1)	01-04 (1) 04-05 (2) 05-06 (1) 03-05 (1)*
Australasia	16-18 (1) 20-22 (1)	06-07 (1) 07-09 (2) 09-11 (1) 15-17 (1) 20-22 (1) 22-00 (3) 00-02 (2) 02-04 (1)	01-03 (1) 03-06 (2) 06-07 (1)	03-06 (1)
Caribbean, Central America & Northern Countries of South America	15-18 (1)** 09-13 (1) 13-15 (2) 15-18 (3) 18-19 (2) 19-20 (1)	06-07 (1) 07-08 (3) 08-10 (4) 10-12 (3) 12-16 (2) 16-18 (3) 18-20 (4) 20-22 (3) 22-00 (2) 00-02 (1)	20-22 (1) 22-23 (2) 23-03 (3) 03-05 (2) 05-06 (1)	22-00 (1) 00-04 (2) 04-05 (1) 00-04 (1)*
Peru, Bolivia, Paraguay, Brazil, Chile, Argentina & Uruguay	14-17 (1)** 09-12 (1) 12-14 (2) 14-17 (3) 17-18 (2) 18-19 (1)	06-07 (1) 07-09 (2) 09-15 (1) 15-17 (2) 17-18 (3) 18-20 (4) 20-21 (3) 21-23 (2) 23-02 (1)	21-23 (1) 23-03 (2) 03-05 (1)	22-04 (1) 00-03 (1)*
McMurdo Sound, Antarctica	*Nil*	18-21 (1) 21-23 (2) 23-01 (1)	22-04 (1) 04-06 (2) 06-07 (1)	04-06 (1)

June 15-August 15, 1976
Time Zone: PDT (24-Hour Time)
WESTERN USA TO:

	15 Meters	*20 Meters*	*40 Meters*	*80 Meters*
Western & Southern Europe & North Africa	*Nil*	06-07 (1) 07-08 (2) 08-14 (1) 14-17 (2) 17-19 (1) 22-00 (1)	20-23 (1)	*Nil*
Central & Northern Europe & European USSR	*Nil*	06-07 (1) 07-09 (2) 09-14 (1) 14-16 (2) 16-18 (1) 21-23 (1)	20-22 (1)	*Nil*
Eastern Mediterranean & Middle East	*Nil*	06-08 (1) 14-16 (1) 19-20 (1) 20-21 (2) 21-22 (1)	20-22 (1)	*Nil*
Western Africa	10-14 (1)	07-09 (1) 14-16 (1) 16-17 (2) 17-19 (3) 19-20 (2) 20-21 (1)	20-23 (1)	*Nil*
Eastern & Central Africa	*Nil*	14-16 (1) 16-18 (2) 18-19 (1) 06-08 (1)	*Nil*	*Nil*
Southern Africa	*Nil*	06-08 (1) 13-16 (1) 22-00 (1)	20-21 (1) 21-22 (2) 22-23 (1)	20-22 (1)
Central & South Asia	*Nil*	07-08 (1) 08-10 (2) 10-11 (1) 18-20 (1) 20-22 (2) 22-23 (1)	05-07 (1) 18-20 (1)	*Nil*
Southeast Asia	19-23 (1)	07-09 (1) 09-11 (2) 11-12 (1) 21-23 (1) 23-01 (2) 01-03 (1)	03-05 (1) 05-06 (2) 06-07 (1)	04-06 (1)

(Continued on page 74)

A. EDWARD HOPPER, W2GT, ON

Awards

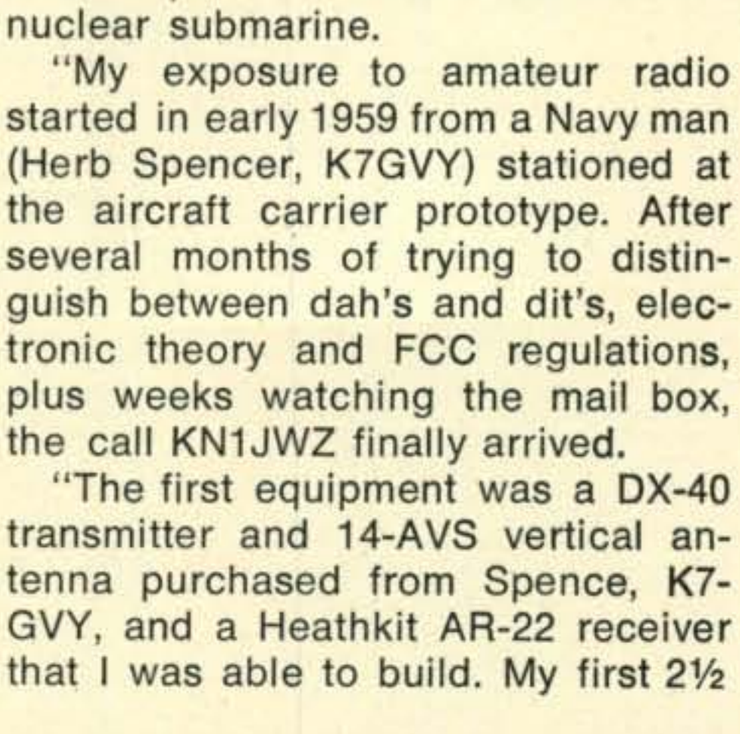
The June, "Story of the Month", as told by Dean is:

Dean W. Laughlin, K7JWZ
All Counties #89, 12-1-72.

"Born May 14, 1929 in Boise, Idaho, the majority of my life has been spent in the upper Snake River Valley of South East Idaho. A period of time was spent at the University of Idaho, then a tour of duty with the U.S. Navy followed by employment in northern Idaho with a Lumber Company. Employment since late 1957 has been with Westinghouse Electric Corp. at the Idaho A.E.C. site as a chemistry technician on the prototypes of a nuclear powered aircraft carrier and nuclear submarine.

"My exposure to amateur radio started in early 1959 from a Navy man (Herb Spencer, K7GVY) stationed at the aircraft carrier prototype. After several months of trying to distinguish between dah's and dit's, electronic theory and FCC regulations, plus weeks watching the mail box, the call KN1JWZ finally arrived.

"The first equipment was a DX-40 transmitter and 14-AVS vertical antenna purchased from Spence, K7-GVY, and a Heathkit AR-22 receiver that I was able to build. My first 2½



Dean, K7JWZ in Billings Montana.

Special Honor Roll
(All Counties)
#142 Howard E. Perkins,
K8EUX 2-17-76
#143 Doug. Bowles, VE4QZ 3-12-76

years of operation were not exciting. Then in January 1962 Kaye and I were married and as Kaye has stated, 'Just looking at the log entries, you can tell when a better piece of gear was acquired'. Probably my sincere feeling for amateur radio would not be what it is today, had it not been for Kaye. She has always encouraged it, whether it be a new piece of gear (if we could afford it) or any other aspect.

"The first mobile rig was the Heathkit Cheyenne with a Webster bandspanner. Then came a Drake TR-3 and Hustler antenna which we still use after many thousands of miles and hours of operation.

"My introduction to County Hunting came in early 1965 on the CHC net. Then on 3-21-65 came the first of many mobile trips. That first trip was only one day covering Bonneville, Jefferson, Madison, Fremont, and Teton Counties in Idaho. Teton County was especially popular, as at that time no one had worked all 3079. K9EAB, WØMCX (WØBK), WØ-JWD (WØBL), K4VOF, and WA9AJF were just a few of those worked that first day. After a time all counties in Idaho had been given out with the exception of Boundary which is about 500 miles from the home QTH. A trip was made thru the Northwestern Montana and into Northern Idaho, but the closer we got, the worse conditions became. Upon reaching Boundary County there were absolutely no signals on 20, 40 or 75 meters. After much frustration tearing the rig and antenna apart, we had to leave without giving out the County. It wasn't until the next day at the QTH of Doc, K7LDK and Fran, K7MRX in Moscow, Idaho we learned there had been a complete radio blackout due to *Aurora Borealis.* Another trip at a later date was more successful. Since then, nearly all counties in the 7th call area have been given out, some of them many times. Since Kaye and I enjoy traveling around the country, counties have been given out in the 5, 6, 7, 9, 0 call areas of the U.S., plus 3 districts in Alaska and also VE3, VE4, VE6, VE7 and VE8 in Canada. During the years I was working for all counties, Kaye and I have had the pleasure of meeting many of the County Hunters. Some at our QTH and many on our frequent travels around the country.

"After several years, with many meals in the ham shack as a county was coming up that I didn't want to miss, the last county was worked at 1744 GMT 11-12-72. The last county, Marshall, Iowa, was worked from my good friend George, WAØLPA.

"As so many others have said, it is impossible to list everyone who made the magic number possible, so thanks to all the net controls, base stations and especially the mobiles for making it possible. We hope that through the years we have been able to help many obtain needed counties and in the future, as time permits, may we continue to do so. Good hunting."

Awards Issued

Howard Perkins, K8EUX hit that magic number of *All Counties.* See Story/Photograph *CQ* December 1967.

Doug. Bowles, VE4QZ also made them *All* and became #7 outside USA, #3 to VE, and #1 to VE4.

Tom Storm, DDS, WAØYJL added USA-CA-3000 to his collection.

Keith Harlow, WA7RKN did his paper work and got USA-CA-500 through USA-CA-2500 endorsed All S.S.B.

Arthur Nelsen, WAØBMO gained USA-CA-2000 endorsed All S.S.B., All 80.

Cesar Santos, CT1UE was issued USA-CA-500 endorsed All S.S.B., #4 to Portugal and USA-CA-1000 endorsed All S.S.B., #2 to Portugal.

Henry Thel, VE7WJ (was VE7AHD until December 1969—also VA7WJ in '73 & '74 as well as 3C7AHD and XJ7WJ) acquired USA-CA-500.

Bob Kemp, WA4CHI obtained USA-CA-500 endorsed All S.S.B., All Mobiles, All 80, All 20.

Awards

New Jersey Bicentennial Award 1976: This Award is sponsored by the Moorestown Astronomy Association to commemorate the U.S.A. Bicentennial by contacting amateurs in New Jersey. To receive this Award you must send G.C.R. List and $1.00 to Moorestown Amateur Astronomy Assn. C/O Gene Bond, WB2UVR, 15 East Camden Avenue, Moorestown, N.J. 08057. AOM/B endorsements free when you apply for them with regular Award, if not they cost 10¢ each plus an s.a.s.e. Required QSOs are:

New Jersey Stations:	Class AA	500
	Class A	100
	Class B	75
	Class C	50
	Class D	25
Other U.S. Stations:	Class AA	200
	Class A	100
	Class B	75
	Class C	50
	Class D	25
V.H.F. Stations in N.J., N.Y., PA, DE. & MD.:	Class AA	200
	Class A	100
	Class B	75
	Class C	50
	Class D	25
DX and other V.H.F. Stns.:	Class AA	75
	Class A	50
	Class B	25
	Class C	15
	Class D	7

Brazilian YL Award-BRYLA: Available to all amateurs after two-way QSOs with:

DX—12 YL stations from different countries (3 continents)
8 YL stations from Brazil.
PY—20 YL stations from Brazil.
5 YL stations from different countries (3 continents)

Contacts must be made from the same QTH, in any band or mode and in accordance with international regulations on amateur radio.

Applicants must submit log data including stations worked, date, time, mode, report and band certified by a recognized amateur radio association. Be sure to send one of your QSLs for BRYLA files and 10 IRCs to: BRYLA, C/O PY1FI, P.O. Box 58, 20.000 Rio, RJ, Brasil, South America. Most active stations are: Phone —PY1BQ, BQI, DNU, DVQ, ETA, EGJ, EN, FI, MEN, OM, 2BEE, JY, PE, 3AVE, 4AKL, DY, MS, VL, 5ACW, BZN, CCY, CFO, IB, XM, 6ACL, ARI, 6BQ, CG, OZ, WZ, 7AL, AVN, BDL, 8JO, NH, 9FJ, LQ. PT2EQI, PT2HQ. On C.W.—PY1DUJ, EUL, SJ, 2ATL, DHP, 5ACW, XM, 7CGV, 9UC/2, PT-2SV.

Texas YL Round-Up YL-OM Certificate: This YL-OM Certificate is awarded for confirmed contacts with stations operated by licensed women amateur radio operators who are full members of the Texas YL Round-Up Net. The certificates are issued under the following rules:

1. Two-way communications must be established on one of the amateur bands with 10 licensed women amateur radio operators who are full members of the Texas YL Round-Up Net. A full member is defined as a licensed YL who has a Certificate of Membership and has paid her dues.

USA-CA Honor Roll

3000	2000	1000
WAØYJL .164	WA7RKN 244	CT1UE ..388
VE4QZ ..165	WAØBMO 245	WA7RKN 389
2500	**1500**	**500**
WA7RKN 205	WA7RKN 293	CT1UE .1093
		VE7WJ .1094
		WA4CHI 1095
		WA7RKN 1096

2. All contacts must be made from the same location, or locations, providing the same call is used and the YL was a full member of the net at the time of the contact.

3. Each member of the net has received a Texas YL Round-Up Net Member Certificate on which there is a number and a date of issuance. The 10 QSLs for the necessary two-way contacts must show the member's Certificate numbers to qualify.

4. Contacts made with members during any regular net meeting will NOT be counted valid for this award.

5. QSLs must be sent to the Custodian by first class mail. They must be accompanied by a list of claimed contacts, arranged alphabetically by call, including call and full name of the operator, certificate number, date, time and band of QSO. Sufficient postage must be enclosed to finance the return of the cards by first class mail, plus 25¢ to cover mailing cost of the award. The Texas YL Round-Up Net will not be responsible for any loss or damage to an applicant's QSL cards.

6. Decisions of the YL-OM Certificate Custodian regarding interpretations of these rules as here stated, or later amended, shall be final.

Texas YL Round-Up Net Certificate.

7. Send applications and confirmations, etc., to: Bernell Johnson, K5-GBX, 1822 S.W. 3rd Street, Grand Prairie, Texas 75050.

Notes

If anything seems a bit strange about my April column, it is because my February column got lost/mislaid but found and now is in April. *CQ.*

Here is the promised data on my ole friend, Henry "Hank" Baarens, with whom I had my first QSO back in 1921 in Hawthorne, N.J. Hank still remembers our first QSO when I said, "Tell Elmore (my cousin) to come home for lunch."

Hank moved in 1923, got the call 2FG, but we lost track of each other until he started to read this column. By that time he had moved from Clifton, to Morristown and now spends summers in Barnegat, N.J. and winters in Homestead, Florida.

He lost interest in amateur radio and lost his 2FG call but a few years after retiring from Bell Labs in 1966, he got the call K2AL. (As I write this, Bob, W2LV, informs me that the present holder of W2FG just became a silent key).

Last year I had the great pleasure of working Hank on 80 on his 73rd birthday. He insists it was one of the nicest birthday presents he has received. We (Helenmae and I) had the pleasure of a wonderful visit with Hank and Margaret last October, just before they left for Florida for the winter. By the time you read this, I hope that Hank and I will resume regular weekly schedules from Barnegat, N.J.

Reliable/documented information has surfaced that make the alleged Mobile trips of WB6CKU a mirage, so no credits can be issued for these trips for USA-CA.

How was your month?

73, Ed., W2GT

Surplus Sidelights

BY GORDON ELIOT WHITE

Last month I described the AN/ARC-38, a Navy high-frequency transceiver, built by Collins, which has been appearing on surplus sales lists. The ARC-38A model is an updated version for sideband use. Both versions cover the frequencies from 2 to 25 MHz with excellent stability and sensitivity.

This month I will describe alignment of the ARC-38, a rather complex job that the Navy accomplished with a raft of test gear. The service used a AN/ARM-29 test bench harness, a MK-380/ARM accessory kit, AN/ARM-26 radio test set, AN/USM-26 frequency meter, AN/TRM-1 radio test set, a dummy load (Bird 82A for example) rated at 51.5 ohms, 500 watts, the TS-505D/U vacuum tube voltmeter, ME-6D/U a.c. v.t.v.m., and a TS-585C/U audio output meter.

More commonly available instruments may be substituted for some of the military test sets, and the operational cables and control head may be used instead of the test harness. The ARM-26 is the most desirable of the military sets, and it would be nice to pick one up along with the ARC-38 if you could find one.

If you don't have all the original test equipment, you can still do an alignment, though perhaps not as quickly as the Navy could. You will need a good frequency meter, a v.t.v.m., dummy load, and a meter suitable for reading audio output level. The latter does not need to be very accurate, as you can adjust for a peak. The absolute readings, unless the set is really in bad shape, are less important.

Using the standard control head, adjust the power input exactly to 25.2 volts and set the frequency selectors to:

A—7000
B—0
C—0
D—0

After the autopositioner cycles, check the set itself to see that the stabilized master oscillator (SMO) dial reads:

A—7
B—0
C—0
D—0

(If the intermittent gear assembly is removed (see last month's column) the reading at **A** will be meaningless.)

Set the SMO correcting capacitor, C-2199, to one-half capacity, using a small screwdriver in the slotted shaft. Check the SMO output frequency. It should be 1,750 kHz, plus or minus 1 kHz. If it requires adjustment, loosen the oscillator coupler with a bristol set-screw wrench. Disengage the oscillator gear by sliding it forward on its shaft and temporarily retighten the set-screw.

Adjust the oscillator by manually rotating the oscillator gear to obtain a frequency of 1,750 kHz, as checked against the frequency meter. Carefully slide the gear back into its normal position, tighten, and re-cycle the autopositioner, checking to see that now the output of the SMO *is* within plus or minus 1,750 kHz.

Now manually adjust C-2199 to bring the SMO output to exactly 1,750 kHz, plus or minus 150 Hz.

Set the controls to:

A—13000
B—900
C—90
D—9.5

After the autopositioner cycles, check to see that readings are:

A—13
B— 9
C— 9
D— 9.5

Now adjust the trimmer coil on the SMO (L-2100) to obtain an output frequency of 3,499.875, plus or minus 150 Hz. Return the frequency selector to 1,750.000 and recheck.

The a.c. voltage at terminal 2 of Z-2207 should be greater than three volts at both ends of the frequency range. Lower voltage indicates need for adjustment of the entire tuning rack, a procedure too complex to go into here. If you can find the manual *(NavAer 16-30ARC38-502)* it gives that data.

Accuracy of the 500 kHz oscillator must be set very closely. Re-check the SMO at 1,750 kHz, then set the unit to 7,099.5 kHz, giving an SMO output of 1,774.875 kHz. That frequency should be accurate within 35 Hz, or should be re-set with an insulated screwdriver in the discriminator trimmer.

(It may be necessary to loosen the discriminator shaft coupler, as was done with the oscillator gear, to get the correct discriminator output at the indicated point.)

The 500 kHz oscillator may be checked by attaching a frequency meter at J-2001 and adjusting the crystal trimmer to exactly 500.000 kHz.

Finally, check the SMO output as follows:

Channel 10 — 1,750.00 kHz
Channel 11 — 2,000.00 kHz
Channel 12 — 2,500.00 kHz
Channel 13 — 3,000.00 kHz
Channel 14 — 3,499.875 kHz

The tuner discriminator check requires use of a gauge block (MK-380/ARM) which may be difficult to locate. It is slipped under the tuning rack assembly when the set is tuned to 2 MHz, and the slug of T-1001 is adjusted to allow the rack to just allow the block to be slipped into position. Using a machinists' dial gauge, the rack should rise to 0.798 inches at 3.7495 MHz, 0.570 inches at 3.25 MHz, 0.342 at 2.75 MHz, and 0.114 at 2.25 MHz.

Transmitter Alignment

Connect the dummy load to the antenna jack and set the controls to 2.0 MHz. With an r.f. probe on the v.t.v.m. attached to the antenna jack via a "T" fitting (UG-107/U) key the transmitter and adjust the following coils for maximum output:

Z-1002
Z-1003
Z-1004
Z-1005
Z-1014
Z-1018
Z-1022

Switch off the transmitter and select 3.7495 MHz and re-align the coils. Switch off again, retune to 7.25 MHz and adjust the slugs of:

Z-1006
Z-1007
Z-1016
Z-1020
Z-1024

Select 14.2495 MHz and re-align the coils a third time.

Tune to 3.75 MHz and adjust for maximum output by tuning slugs in:

Z-1015
Z-1019
Z-1023

Now tune for maximum with C-1114 (bottom of tuner assembly) while the set is cycled to 7.2495 MHz. Select 14.25 MHz and tune slugs:

Z-1008
Z-1009
Z-1017
Z-1021
Z-1025

Select 24.99 MHz and re-tune the same coils to maximum output.

Receiver Antenna Coils

With signal generator input of 2 MHz, 30% modulation, and an audio meter attached to the receiver output, adjust the input to give a mid-range reading on the audio meter. Tune the set, of course, to 2.0 MHz.

Connect a d.c. voltage test lead (v.t.v.m.) to test point J-901 (a.v.c. voltage). About 30 volts positive should be present with no signal applied.

Adjust the slug in Z-1010 for maximum reading at J-901 with r.f. signal applied (about 10-15 volts at J-901).

Select 3.7495 and reset the receiver and frequency meter. Adjust the trimmer capacitor on Z-1010 for maximum output.

At 3.75 MHz, adjust the slug on Z-1011, and adjust the capacitor on Z-1011 at 7.2495 MHz. At 7.25 MHz, adjust the Z-1012 slug for maximum, and adjust the Z-1012 capacitor at 14.2495 MHz.

At 14.25 MHz, adjust the Z-1013 slug, and at 25.0 MHz, trim the Z-1013 capacitor for maximum.

The 250 kHz i.f. amplifier generally does not require re-alignment unless it has been damaged; refer to the manual if necessary. ■

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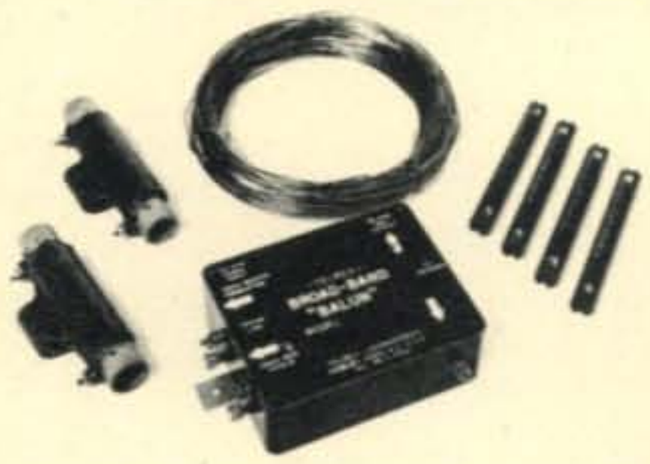

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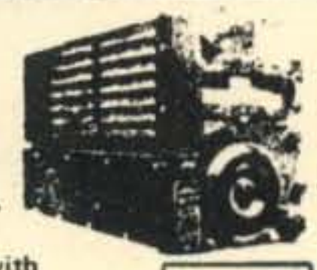

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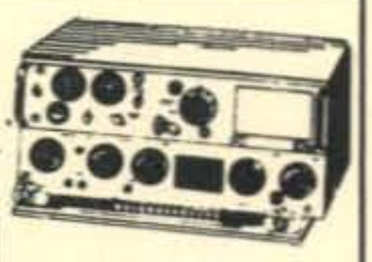

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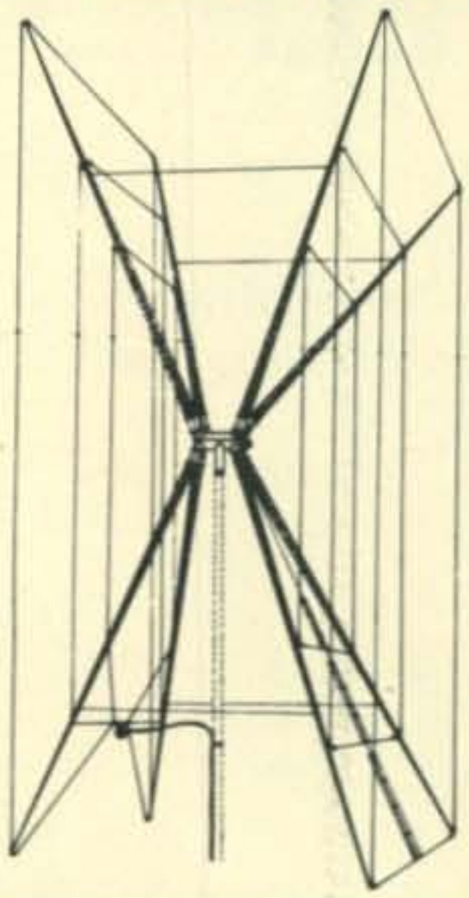

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A Canoe And PM-2B DXpedition *(from page 20)*

The Beginning

Two weeks use and the batteries still put out 240 ma through a 50 ohm resistor compared to 250 when fully charged. Guess we could have stayed a month or so!

QRPp will be along on future trips and not as EXTRA weight—no more worry about emergencies with such dedicated operators in the net system.

As WA1FCM said about emergency communications in the Sept. *QST*, "Flea power is more effective than no power."

Try it. With a little patience you'll have a ball! ■

Making IC Projects Work *(from page 38)*

great care be taken to check and double check the schematic diagram for any possible errors. Such drawing errors seem to creep into even the most carefully edited writeups. If anything appears doubtful it is often time and money saving to write the author about those doubts. I have had the good fortune to receive many kind and considerate replies whenever I've written asking for advice or questioning a schematic. Usually, the author is far ahead of the builder and has an errata sheet already made out that will help in the successful completion of the project.

This is the first part of "How To Make IC Projects Work". I will discuss some additional problems facing the builder in a following article having to do with making the hardware work. Generally the problems involved in the follow on phases of work include finding and correcting wiring errors, cold solder joints and solder bridges and other mechanical problems, establishing a methodology or scheme for tracing through a hardware solid state system to find out what went wrong where, seeking out actual mistakes in the drawings and schematics originally used and not the least important, establishing the criteria that should exist even before the power switch is turned on and how to sequentially check each part of the system so as not to damage assembled hardware by moving too fast in turning on the switch to "see what happens". Believe me it usually will.

It is my hope that this article will help the amateur system builder have the courage to get started on a large and for an amateur usually costly IC project. I have found out from my experience that if a problem can be broken down into small usable parts that it doesn't appear as difficult to handle.

(To be continued)

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(c) W9LUO, SSTV Monitor Mk I, *QST* March 1972, Mk II *QST*, March 1973
(d) WB9LVI, Slow to Fast Scan Converter, *QST* March 1975, May 1975
2. (a) Protoboard 100 series, Continental Specialties Corp. P.O. Box 1942, New Haven, Ct. 06509
(b) Micro-Vector plugboards, Vector Electronics Co., Inc. 12460 Gladstone Ave., Sylmar, Ca. 91342
(c) *Electronics* magazine, February 19, 1976, Special issue on "Breadboards".
3. WB9LVI, Slow to Fast Scan Converters, *QST*, May 1975 page 30, figure 11.
The 2521 MOS shift registers are returned to —8 volts.
4. Signetics Data Book, C1974 pg. 2-87.
5. Fairchild Manual "MOS Integrated Circuits," C1974 pg. 5-17.

Phone Contest Story *(from page 29)*

anyone work zones 34, 35, 36? . . . *HL9TB.* It was very hard to break through the JA "radio wall" to the Stateside; on the other hand, JA gave me lots of QSO points . . . *BV2B.* Finally got my 10 meter opening to Europe. 21 new countries! . . . *9V1SH.* Really enjoyed the contest, my first CQ WW DX Phone. Could have done better If I got my 3 el beam up, but beam was on the ground due to bad weather and storm out here. So have to try on the 19-year old folded dipole. Great difficulty copying during the daytime due to very bad splatter from a nearby B'cast station (less than ¼ mile away radiating 100 KW on 7250 kHz. I hope to try my best in the CQ CW 'test with my beam up . . . *9M2FK.* I hope my income tax is easier to complete than this log!! . . . *WA6LRG/KB6.* Pleased to QSO Paraguay after 35 years. Always a wonderful contest to take part in. One of the supreme joys of ham radio . . . *VK5MF.* Fantastic condx. Wrk 3 new ones. *VX9A* ans. my CQ . . . *VE3ECP.* Terrible line noise up to 10 over 9—stopped just B4 end of contest . . . *XJ3BMV.* Just dabbled for new countries this year. Last yr. operated from Fiji as *3D2DD.* Some difference! . . . *VE3EZM.* What happened to 40 m? . . . *VE2AYU.* No fun at all to get the logs to you in time with the mail strike in Canada. Trying to locate a friendly U.S.-bound stewardess to mail my logs from Boston . . . *VE1AIH.* Good contest as always—sure wish 10 m. had been open . . . *KL7IDH. 7P8AC* called me in one of my pileups. Africa tough from here . . . *KL7HCN.* Too big a pile-up on 21MHz. U.S. East coast stations breaking every moment when I tried to pick-up a W6 or W7 . . . *LX1BW.* One QSO every 5 minutes from *8R1G* operator, because there were 1000 calls everytime he called, Hi . . . *HB9ZE.* Operating from a temporary position in the living room with the kids playing around did not bring in a high score . . . *PAØTO.* 160 meter activity way down compared to last year. I think 160m should get a special multiplier to stimulate activity . . . *PAØHIP.* My first go at the phone contest . . . *9H1CH.* The special callsign increased my usual number of QSO's, but it was hard to understand by the people working me . . . *IV3VLS* (Opr. *I3PRK).* QRM, QRM, QRM on 80!!! . . . *I4ZSQ.* It's always the best contest . . . *I2TTL.* Fantastic discipline of JA's enabled HL, VR1, VS6 and DU stations through the pile-ups . . . *VZ0SRJ.* Big surprise when a YB in Indonesia came through 59 on 10 meters—an otherwise dead band . . . *LA5JS.* The USA Boys are very good operators . . . *SM7TV.* S 7 to 8 noise level from leaky insulator—fixed 2 days after contest . . . *VE4SN.* Very good condx. from Central Canada . . . never thought the bands could be so crowded. Like good old times . . . *VE4RP.* Rotator problems—rotobrake broke—pulled coax from balun—had to butcher balun from 40 m and install on TH6DXX—*3A0HF, FR8AH, VR1AA, JW5NM, 9H1DZ, HBØLL, 5B4ES,* all answered *my* CQ's . . . *XJ3GCO.* Lots of competition in VE3 (XJ3??) this yr. A pleasure to use long yagi for first time. My first contest since the ant farm was leveled in the Bermuda Contest . . . *VE3KZ.* Condx to Europe this year were unsurpassed. *VE7BWK/3* was wiping me out into Europe so I spent lot of time with W/K to make up . . . *XJ3EDC.* I am very glad, I could QSO 4 new countries . . . *JA2HLX.* May these good condx continue forever!! . . . *JR2FNL.* I wonder how many JA's send their results of the contest to you? I hear more than 300 stations in the contest every year . . . *JA1BII.* Cndx very poor on 28 MHz but we could QSO with *OH3X2* and *K6SEN* . . . *JH7KUP.* The propagation was especially beautiful to Europe. EU's coming through all the afternoon until the sunset. I appreciate this contest . . . *JH2IXQ.* This is my very first experience and felt interest! . . . *JR2HDS.* I am happy to play contest. *JA5PXG.* It seems that the propogation was very good compared with last year . . . *JG1UNF.* I am certainly pleasantly surprised that my peanut whistle is getting out much points for me . . . *JR1RWZ.* Happy New Year . . . *PY3CFP.* Tremendous operating experience . . . *PY2DOF.* I had no plans to work the contest but worked quite a lot of stations . . . after contest, I asked a friend to tell me how to do the log and where to send it . . . *PY2JY.* Although having worked with a limited schedule . . . I was lucky enough to work a few new prefixes & countries . . . *PY1FI.* In the midst of the contest had to relay emergency traffic (accident) where were the Europeans? QSO's on 1.8, 3.5 & 7 MHz ought to be worth more than 3 points . . . *CP1AT.* It's a great contest. Sleepiness overcame my willpower after 2400 GMT . . . *LU1ADI.* Had sked with *HL9TB* on 80 hrd him 5/7 but I had to transmit on a different freq . . . worked VK6 at the last minute but someone said 'Your watch is 3 mins. slow' . . . *LU2AFH.* Poor operating caused my low score—condx were fantastic. *KV4FZ* was a great help. During my stay at St. Croix next yr. it'll be different . . . *LU2DC/KV4.* Propagation very poor for long periods during contest, particularly Oct. 25. . . . *VK3ARY.* Last run into Europe just like JA's generally are . . . *VK5SM.* Thanks for a fine contest, but lucky condx were good that weekend. The two following weekends were very flat from here . . . *VK2CW.* Best October weekend and I had to miss it for your flaming Contest. At least I can count to ten in Japanese! . . .

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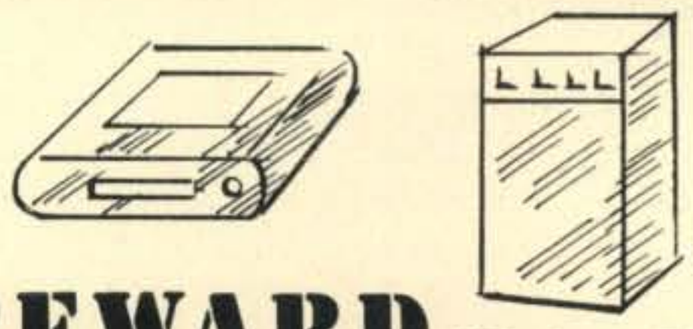

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Phone Contest Results

(from page 32)

UO5OAK					
	14	40,256	283	22	52
UO5GR	7	3,230	73	6	28
Eu. Russia					
UA3VAQ	A	596,097	995	84	237
UA3DFK	"	568,013	1,214	63	188
UA4NAA	"	421,776	971	58	144
UV3DN	"	250,475	659	59	156
UW1AE	"	190,082	494	59	143
UW3EQ	"	156,023	423	58	159
UA6GL	"	78,585	369	38	117
UA6JAD	"	77,172	426	36	82
UA3TN	"	72,048	324	43	115
UA3FT	"	63,360	144	36	108
UA6LWI	"	57,582	379	31	95
UA3ST	"	52,644	308	31	76
UA4ZA	"	49,005	271	37	84
UW6LC	"	48,120	222	37	83
UV3FD	"	45,150	261	39	66
UK3ABX	"	32,554	224	19	63
UK3DBT	"	30,096	216	23	65
UA3VCC	"	17,794	201	15	47
UA3XAW	"	14,910	170	16	55
UA3IAM	"	13,860	81	27	43
UA3LAB	"	13,350	86	25	50
UA4CO	"	9,906	75	26	52
UV3CS	"	9,513	101	21	42
UA4DL	"	8,670	99	15	36
UA3DDF	"	6,426	99	15	39
UW3RR	"	5,704	65	20	42
UA6AJG	"	4,200	62	13	37
UA3WZ	"	520	23	7	13
UA6LBC					
	28	20,661	190	19	52
UA4WPF	"	6,084	114	10	29
UA3TCH	"	4,708	71	12	32
RA3DQP	"	4,640	92	11	29
RA4HDE	"	3,312	75	9	27
RA3AKX	"	1,815	40	10	23
UA3DDV	"	476	26	4	13
UA1CS	21	205,683	739	31	80
UW3EH	"	91,300	610	21	62
UA3ERD	"	52,614	323	22	57
UA36BU	"	52,416	402	21	57
UA6BV	"	42,240	378	21	59
UA6HBU	"	33,418	252	19	43
UW6CV	"	16,688	206	19	37
UA1QBE	"	8,702	167	9	29
UW3TP	"	4,104	66	12	24
UA6DL	14	455,796	1,749	33	99
UA3GM	"	65,312	253	29	75
UA3GEA	"	11,468	188	8	39
UW1AX	"	1,856	34	12	20
UA3AAK	"	1,352	44	7	19
UW3IN	"	572	12	9	13
UA6RB	"	486	12	8	10
UA4UAZ					
	3.8	10,879	219	9	33
UA6CQ	"	4,544	119	6	26
Ukraine					
UB5WF	A				
		2,016,483	2,224	94	299
UY5EG	"	748,322	1,277	83	210
UY5OO	"	496,016	1,033	65	167
UB5AAF	"	384,076	850	76	225
UB5VBY	"	43,587	427	21	66
UB5LU	"	41,736	249	31	80
UB5PS	"	9,585	107	52	135
UB5ABJ	"	6,708	113	14	38
UB5VAL	"	3,713	43	16	31
UB5LAY	"	1,820	35	10	25
UB5WAD	"	1,080	39	7	20
UB5VAZ					
	28	14,310	216	15	38
UB5VAF	"	7,788	171	11	33
UB5ABK	"	4,752	108	10	26
UB5MET	"	2,040	54	10	20
UB5DAE	"	476	18	6	11
RB5IOV	"	2	1	1	1
UK5JAA					
	21	143,350	633	33	89
UY5OQ	"	51,340	431	18	50
UB5SJ	"	30,450	248	19	56
UB5GBD	"	18,531	134	21	50
UY5HF	"	13,334	119	18	41
UB5EC	14	400,862	1,175	36	118
UK5WBG	"	154,562	776	30	79
UY5HV	"	72,150	410	29	82
UB5XY	"	34,800	348	18	57
UB5OD	"	23,184	151	23	61
UT5LY	"	12,000	203	8	42
UK5AAA	"	384	19	6	10
UB5YAR					
	3.8	9,576	245	7	31
UB5YBC	"	6,016	176	6	26
UB5UBJ	"	4,488	111	8	25
UK5YAR	"	3,164	102	6	22
UB5CAT	"	288	19	4	12

OCEANIA

American Phoenix Islands					
WA6LRG/KB6					
	14	299,556	1,012	33	73
Australia					
VK4UR	A	242,951	672	40	87
VK4FH	A	183,300	630	37	63
VK5MF	A	159,063	489	39	72
VK3ARY	A	123,541	355	43	78
VK3SM	A	42,016	141	35	66
VK2OW	A	24,024	106	33	55
VK4PJ	A	18,522	101	24	39
VK3VQ	A	11,346	65	25	37
VK4UU	A	7,943	57	16	31
VK6CT	21	468,309	1,427	29	82
VK4DO	14	18,428	104	24	44
VK5BS	14	3,900	38	13	26
VK5WO	14	2,352	30	11	17
VK4LX	7	22,412	153	20	32
VK3XB	3.5	8,379	145	10	11
Gilbert Islands					
VR1AA	A	261,052	522	76	111
Guam. Mariana Islands					
KG6JFY	A	392,730	1,169	54	60
KG6JAR	14	462	16	5	6
Hawaii					
KH6IJ	A				
		1,334,236	2,395	76	112
KH6ABF	A	30,720	162	29	35
KH6IPY	A	13,284	139	16	20
KH6AHZ					
	28	18,336	134	16	32
KH6CKJ					
	21	112,280	926	16	24
KH6IJA	21	109,872	665	19	37
KH6IAC	14	328,776	1,355	29	55
KH6BZF	14	226,009	955	26	57
KH6GQW					
	3.5	36,050	364	13	22
Indonesia					
YB0ABV	A	212,984	464	55	103
Marshall Islands					
KX6LQ	A	126,854	380	47	72
New Hebrides					
YJ8AN	A	177,572	630	39	64
New Zealand					
ZL1BKX	A				
		1,074,674	1,453	80	174
ZL1AGO	A	402,270	856	61	104
ZL1TB	A	8,478	59	19	35
ZL2BCO	21	30,899	200	17	36
ZL1AMM					
	21	17,346	145	13	29
ZL1AAS	14	189,960	541	31	89
ZL1AMO					
	3.5	48,384	295	21	35

SOUTH AMERICA

Argentina					
LU2AFH	A	771,390	1,009	88	182
LU7MAY	"	725,109	1,103	81	150
LU8FEU	28	166,452	715	21	57
LU7MAO					
	28	12	2	2	2
LU4MBI	21	39,300	332	17	33
LU8PM	21	25,772	259	13	21
LUIADI	14	3,218	48	17	17
Bolivia					
CP1AT	A	150,824	431	55	81
Brazil					
PY7AZO	A	132,912	321	41	101
PY2GNR	A	85,085	228	46	97
PY1BAR	"	67,973	239	30	71
PY1CHP	"	67,322	283	32	50
PT2JB	"	56,250	262	26	49
PY1FI	"	52,593	171	46	95
PY2JY	"	36,900	169	29	46
PY2OB	"	23,650	89	35	51
PY2FXU	"	10,045	75	22	27
PY1BOL	"	2,059	25	12	17
PY3BXW					
	28	125,624	516	24	58
PY3CFP	"	38,280	218	21	39
PY1NEW	"	4,031	53	12	17
PY2FMP	21	103,314	523	17	50
PY4BOC	"	179,452	551	30	86
PY2DLG	14	1,760	22	10	20
PY2ELZ	7	20,592	145	18	34
PY2DOF	7	2,884	42	12	16
Chile					
CE3EZ	A	18,620	100	34	36
CE4EM	28	60,780	355	20	40
CE2MZ	14	39,900	247	21	49
Colombia					
5J4AOY	A	605,085	1,419	49	96
HK6BRK	"	16,259	84	29	42
HK1CMX					
	14	194,208	681	22	74
5J4EB	1.8	460	16	5	5
Easter Island					
CE0AE	14	140	8	5	5
Ecuador					
K4ERO/HC1					
	3.5	6,851	135	7	10
Falkland Islands					
VP8ON	A	24,480	124	38	58
VP8NX	7	2	2	1	2
French Guiana					
FY7AK	A				
		6,636,348	4,568	126	372
					(Opr. F5QQ)
Peru					
OA8V	A	142,785	305	53	118
OA4VR	7	28,478	178	18	40
Trinidad & Tobago					
9Y4NP	A				
		1,000,692	1,530	58	170
Uruguay					
CW3BR	14				
		1,104,872	2,285	37	130
CV4CR	28	668,624	1,745	30	101
CX8BE	"	271,353	1,063	22	65
CX3BH	21	505,788	1,528	25	88
Venezuela					
YV5ENI	A	247,270	530	45	113
YV5YL	"	31,714	125	40	61
YV4YC	21	436,008	1,339	25	86
YV2AMM					
	14	608,069	1,404	35	114
YV1EJ	"	25,263	151	20	43
YV5AK	"	17,263	101	19	42
4M4GD	7	55,704	209	19	47
YV4EI	"	27,652	160	18	44

Multi-Operator Single Transmitter

UNITED STATES

WA1NZT	1,090,800	983	96	304
WA1STN	1,016,760	979	93	277
W1MX	760,377	811	77	262
WA1QNF	156,800	300	54	146
W2HPF	1,396,747	1109	104	347
K2BMI	809,600	811	97	255
K2FL	461,760	553	81	231
W2YD	405,285	685	58	147
W2UI	185,730	341	65	140
K2GXT	59,782	268	46	96
K3GJD	852,110	824	95	275
W9SZR/3	685,308	814	70	229
K3BW	468,963	577	73	224
W3NX	317,746	420	71	215
K3AVT	308,264	448	69	179
K3RLE	238,005	414	62	153
WA4LZR	1,004,350	940	95	284
W4YWX	907,060	795	99	319
WA4BTC	809,756	771	99	289
WA4CTC	563,500	637	80	242
K4WAR	389,160	524	70	206
K4EBY	198,660	348	59	151
WB5EPY	323,323	470	73	174
WB5HVY	187,200	319	68	157
W5RRR	43,896	134	39	85
W6ONV	1,660,395	1644	105	242
W6PAA	1,091,860	1248	100	208
WB6KBK	706,260	807	99	217
WB6GFJ	464,196	791	67	135
W6KG	329,406	615	72	114
W6UA	256,080	350	78	186
K3MNT/7	1,299,455	1543	95	198
W7VRO	758,580	949	89	193
K8YZW	628,140	764	79	211
WB8LDH	252,216	389	74	174
WB8IAY	243,100	348	80	195
WB8QJL	53,500	170	30	89
W9LT	997,040	859	109	331
WA9PBK	621,173	669	90	253
WB9BWU	613,558	665	90	244
WA9IVL	478,629	573	79	232
K9KWK	73,899	173	52	109
W0MYN	664,089	744	87	236
WB0NHG	540,000	676	91	197
W0EEE	248,976	381	73	179
W0CIV	30,780	208	33	62
Antigua				
VP2A	1,521,036	2828	74	179
Bermuda				
W4EV/VP9	860,034	1668	65	169
Canada				
XJ3FFA	791,824	1285	54	178
CY6AO	577,600	1600	55	105
Guadeloupe				
FG0MM	3,035,840	4405	87	233
Mexico				
6D2MX	404,135	1347	53	78
Montserrat				
VP2M	5,792,750	5344	122	371
Puerto Rico				
KP4AXM	522,236	1471	56	110
St. Martin				
PJ8YFQ	1,784,518	2482	79	223
Turks & Caicos				
VP5WW	3,532,797	4592	86	247

AFRICA

Canary Islands				
EA8CR	4,673,005	3027	120	403
Liberia				
5L2A	2,404,974	2843	84	202
South Africa				
ZS6ERB	65,448	304	23	49

ASIA

Japan				
JA2YAB	1,225,708	1330	112	201
JA9YBA	568,960	925	82	142
KA6YL	278,055	556	68	117
JA6YAP	101,053	263	57	82
JA1ZLO	54,000	182	48	60
JA3YCZ	40,356	195	34	42
JA2ZAP	10,972	80	27	25
U.S.S.R.				
UK9AAN	4,328,390	2774	129	416
UK9QAA	352,152	713	53	148
UK9OAP	15,438	102	19	43
UK9CCE	2,516	29	12	22
UK0AAB	1,064,887	1598	70	193
UK0FAA	393,578	1287	59	99
UK0SAA	127,210	671	30	65
UK0CBE	88,666	582	31	55

EUROPE

Austria				
OE7UU	754,570	1282	77	228
Belgium				
ON5MP	558,782	1167	65	174
Bulgaria				
LZ2KKZ	617,865	1722	61	182
LZ1KDP	45,080	368	25	73
LZ0BFR	8,928	166	9	39
Czechoslovakia				
OK3KAP	494,426	1004	63	170
OK1KSO/P	441,090	873	74	160
OK1KCP	65,250	331	32	55
OK1KSL	38,864	303	27	85
OK1KRQ	7,638	132	13	44
OK3KFO	276	26	3	9
England				
G4DAA	2,728,028	2639	103	285
G3WYX	2,488,990	2579	98	272
G3RCV	1,400,888	1776	85	243
G3RAC	1,108,978	1359	94	244
G8JC	838,662	1291	78	213
G5YC	718,788	1265	67	191
G3KMI	648,456	1306	69	177
G3UNU	90,147	388	40	111
G3EBH	76,024	277	36	100
Federal Republic of Germany				
DL0WU	4,208,312	3237	111	367
DL0JK	1,449,249	1848	82	221
DL0KL	1,083,032	1359	88	243
DJ0EK	926,590	1268	83	222
DL0UE	881,782	1292	82	216
DL8HA	789,225	1236	66	189
DL0IB	734,112	1046	79	209
DK9RM	411,215	968	53	154
DL0BW	131,250	472	49	126
DF5GV	21,567	166	22	69
Finland				
OH2BM	1,875,477	2085	111	290
OH6DX	1,731,840	1798	105	305
OH4RH	1,155,736	1700	79	213
OH3EW	287,106	633	65	153
France				
F6DWY	60,672	341	46	82
German Democratic Republic				
DM2DUK	2,632,372	2980	104	294
Hungary				
HA3KMA	936,730	1527	82	249
HA5KFN/5	916,344	1387	78	234
HA5KKV/7	542,912	1070	68	204
HA0KLE	469,504	1012	69	193
HA5KDQ	460,288	867	69	163
HA4KYH	327,096	730	61	137
HA9KOL	292,600	805	50	140
HA6KNI	246,480	675	52	156
HA0KDA	172,935	540	54	129
HA2KRB	150,060	443	53	152
HA3KHC	132,300	521	46	134
HA6KVB	89,509	483	30	103
HA9KOV	82,304	398	36	92
Italy				
I1DSG	1,914,525	2188	88	247
I1KN	792,077	1106	86	233
I2VTB	527,250	901	67	183
I4JEK	375,550	1033	50	125
I4XZC	197,268	435	62	142
I.T.U.				
4UITU	525,770	1008	75	184
The Netherlands				
PI1PT	27,264	201	28	68
Poland				
SP6PZB	1,410,941	1729	89	264
SP9KRT	298,960	917	49	153
SP6KDA	122,915	515	38	117
SP3GEM	1,479	17	8	21
SP2DVH	980	35	5	23
SP9KOT	966	46	5	16
SP3GUA	576	34	4	12
Portugal				
CT1OY	1,246,256	1758	80	212
Romania				
YO8KAN	280,136	901	48	146
YO4KBJ	267,240	923	48	156
Scotland				
GM3ZRC	63,427	387	25	66
Sweden				
SM5AOE	1,575,798	1880	96	261
SK6AB	1,433,700	1990	88	236
SK2AU	724,980	1137	75	206
SM5AZU	84,480	279	48	117
Vatican				
HV3SJ	1,836,580	2276	92	309
Yugoslavia				
YZ3TDX	1,499,757	1938	89	268
YZ1ABF	378,658	845	60	199
YU4EXA	221,628	574	61	192
YZ1FJK	27,264	180	28	68
YZ2CBM	16,544	118	31	57
Wales				
GW4ENT	1,450,086	2424	71	183
GW3XNS	145,920	510	39	121

OCEANIA

New Zealand				
ZL1AA	30,208	190	26	38

SOUTH AMERICA

Brazil				
PY1EMM	2,873,068	2916	93	241
PY3AHS	1,172,037	1310	94	215
Venezuela				
4M7AA	243,815	597	51	92

U.S.S.R.

Byelo Russia				
UK2AAB	131,196	518	42	114
UK2OAA	11,242	138	19	54
Estonia				
UK2RBA	325,972	916	56	171
UK2TAB	4,788	89	12	26
Georgia				
UK6FAA	56,146	307	16	51
Kazakh				
UK7LAH	1,034,556	1434	76	216
UK7AAF	96,921	347	24	75
UK7LAF	43,688	173	26	60
UK7FAP	6,665	61	13	30
Latvia				
UK2GKW	729,652	1623	51	155
UK2GAG	618,552	1217	63	179
UK2GJB	59,455	449	26	89
Lithuania				
UK2BAS	1,293,394	1648	85	264
UK2PAF	835,068	1277	79	224
UK2PAT	171,444	709	45	137
UK2BAV	168,889	725	36	125
UK2PBK	60,536	503	23	77
UK2BAB	14,910	141	22	48
Eu. Russia				
UK6APA	3,705,171	3476	106	311
UK3AAO	2,998,526	2492	115	343
UK3ABB	2,654,520	2111	105	335
UK3SAB	1,539,532	1979	87	241
UK6LAZ	1,485,306	1762	95	292
UK3AAC	1,316,658	1962	84	248
UK3ABO	557,514	1016	73	209
UK3QAA	502,250	1127	62	183
UK3QAE	397,404	1044	62	166
UK3WAC	354,960	1030	57	175
UK4WAB	333,465	825	57	158
UK3TBF	307,572	756	59	169
UK3AAI	252,150	667	60	145
UK3YAI	246,776	743	54	164
UK3ACM	221,774	591	55	162
UK3MAA	125,818	477	42	112
UK3EAA	81,871	410	38	101
UK4LAC	73,815	701	31	90
UK3DBA	70,087	463	29	80
UK1WAA	42,904	327	30	94
UK4AAA	35,552	227	30	71
UK6YAB	25,608	286	18	48
UK6LKP	24,929	210	22	75
UK6AAJ	23,680	247	23	57
UK4PAE	21,330	172	28	62
UK4YAN	20,075	194	21	63
UK3DCC	18,605	245	13	48
UK4PNZ	3,650	55	17	30
Ukraine				
UK5MAF	2,249,896	2480	108	299
UK5IAA	818,059	1372	88	253
UK5QBE	414,932	1077	52	151
UK5MAG	290,304	1136	70	190
UK5WAZ	285,584	800	51	208
UK5EDB	221,364	752	38	118
UK5VAD	201,970	648	50	140
UK5IAI	108,378	322	54	108
UK5ZAK	64,260	416	31	88
UK5VAH	48,675	364	22	53
UK5EDQ	19,491	202	19	54
UK5LAS	11,872	169	17	39

Multi-Op., Multi-Xmtr

NORTH AMERICA

W2PV	6,052,867	3578	143	486
W3AU	5,494,944	3055	140	489
WA2ZAA	5,283,540	3163	130	466
K6SEN	4,170,084	2855	143	378
WA8ZDF	4,108,115	2689	133	432
W3WJD	4,082,784	2581	130	438
W3GPE	3,996,737	2544	130	433
W4BVV	3,719,430	2350	129	456
WB5OOE	3,387,500	2246	127	415
VX9A	3,322,611	5109	77	202
WB5DTX	3,293,472	2172	130	416
W7SFA	2,888,704	2462	120	296
W3FRY	2,424,246	1766	125	381
ZF1WW	2,410,752	4269	63	193
W3BWZ	1,501,200	1201	110	340
WA3ATX	1,191,762	1019	100	329
WA5LES	1,154,554	988	110	327
W3DHM	988,002	876	90	303
K4CG	981,750	853	102	323
H31KC	775,720	1573	67	153
W4USN	726,948	722	91	290
K2CW/2	698,472	781	76	251
W4MII	583,968	692	88	228
W4QAW	562,520	590	87	256
LU1BAR/W3	510,080	611	86	234
K3TGM	301,665	429	65	190
WA4YBV	255,120	409	67	173
W3TV	193,404	325	54	159
W3FA	136,675	296	52	123

EUROPE

DL0PG	7,930,918	5535	134	483
DK2BI	6,059,119	4528	123	424
DK0KX	4,479,037	3850	120	401
OH1AA	4,371,132	3716	136	427
DL0WW	4,204,565	3431	130	405
OH2AW	3,631,195	3451	114	371
GB3MCG	3,123,124	3303	102	307
HB9H	2,101,440	2528	106	374
SK5AA	742,000	1469	70	201
YZ2CBV	558,600	1177	67	218
DL0II	107,217	414	46	125

OCEANIA

KS6FF	2,249,304	3504	77	145

ASIA

JA3YKC	1,241,229	1366	112	207
JA1YFL	830,323	990	107	192
JA7YRR	681,600	1212	78	135
JH1YDT	581,210	890	87	143
JA6YTU	348,493	635	78	119
JA3YDS	147,968	397	52	84

SOUTH AMERICA

PJ1AA	6,989,316	5055	116	362

Our deep thanks to the following stations who sent in check logs, and to those whose logs we solicited for checking purposes:

OZ7XU, SP9CXM, LA2SQ, SP9DLS, LA8BN, SM5UF, PA1GRE, SM5BNZ, HA5HR, SL5ZW, LA7ZN, LA2CQ, PA0LEG, SM7ASN, LA2ZR, YO9-8593/PH, SP9CSU, SP5JB, SP5IFU, SP4HCU, W/SK, W4ZT, WB5MSX, WA5NDV, W6CLM, WA9UCK, JA1-18987, VE3NE, DM-2BKH, DM2BYN, DM2BYO, DM2-CBB, DM2CMF/P, DM2COJ, DM-2CTF, DM2CWJ, DM2CZF, DM2-FBN, DM2FGN, DM2YLO, DM3RTG, DM3VUH, DM3YPE, DM-2703/A, OH5MJ, OH5YX, OH5ZP, OK1AJJ, OK1AMB, OK1ATO, OK1JH/P, OK1TA, OK3CAW, OK3CFA, W1YN, K2DT, K3DR, K2MFY, WA/ORP, W4JUK.

STATION OPERATORS

Multi-Operator Single-Transmitter

CT1OY & K7CBZ. **CY6AO:** CY6AGV, CY6GN, CY6CCB, CY6AVO, CY6AP, CY6ANO, CY6BK, CY6TK, CY6JD, CY6ASA, CY6CEC, CY6AMR, CY6AMU, CY6CFR, CY6CDA, CY6AYX. **XJ3AA:** VE3FFA & VE3ABG. **DLØWU:** DK4TP, DK5EZ, DJ4AX, DJ8SW. **DLØJK:** DK1DU, DK2XX, DK8ZK, DK8ZL, DF1FL, DF2FK. **DLØKL:** DJ2EH, DK7NM, DK6NN, DJ4BE, DK9NV, DK9NU. **DJØEK** & DJØBA. **DL0UE:** DL3LU, DJ5FW, DJ4GO, DK4OV, DK2SS, DL8RL. **DL8HA** & DL8CM, DL8CH, DL8FR. **DL0IB:** DF1SD, DF1SR, DF2SJ, DF2SR, DF4SN, DJ3SR, DJØRQ, DJØYI, DL1SE. **DK9RM** & DL3RJ, DL2RM, DK3RY. DL08W: DF3FB, DF3FD, DF2FJ. **DM2DUK** & DM2AYK. **EA8CR** & EA8LO, OH2MM. **F6DWY** & F6DXF. **FGØMM:** WA1JKJ, WA1JYY. **G3WYX** & G3HTA, G3RUV, G3TJW. **G4DAA:** G3FXB, G3MXJ, G3XBN, G3ZQW, G4BUE, G4BVH, G8KMQ. **G3RCV:** G3XMD, G3RZP, G3ZAY, G8KNW. **G3RAC:** G3XVR, G4BRK, G4ASV, G3ZZI, G8DMJ. **G8JC:** G3RMF, G3TOD, G3TOZ, G4BXS, G4CXM, G4DXD, G4DXE, G8JBU. **G5YC:** G5AQO, G8IPX, G4CEC, G4CEK, G8JQE, G8JON, G6VF, G3PAF. **G3KMI:** G3ZYW, G3WIE, G4AMI, G4CEN, G4AMH, G8KGG, G4DMY, G4ATU, G3ZER, G4DZC. **G3UNU:** G4BVY, G4DUA, GD8EXI, G8FXO, G8KDO, G8KYE, G8HNF. **G3EBH** & G3TGK. **GM3ZRC:** GM3HZN, GM3LRG, GM3LYI, GM3XNJ, GM4DGE. **GW4ENT:** GW3LDC, GW3NWS, GW4BLE. **GW3XNS** & GW3YFD. **HA3KMA:** HA3ME, HA3MG, HA3PG, Laszlo, Egon. **HA5KFN/5:** HA5HY, HA5GF, H5-513, H5-503, H5-504. **HA5KKC/7:** HA5MA, HA5MD, HA5MO. **HAØKLE:** HAØLO, HAØLZ, HAØMJ, HAØLJ, HAØ543. **HA5KDQ:** HA5KO, HA5HO, HA5FM. **HA4KYH:** HA4YL, HA4YO, Zoltan, Antal. **HA9KOL:** HA9OT, Geza, HA9PB. **HA6KNI:** HA6NN, Vegerti, Denesi, Tozer Gy, Szaboj. **HAØKDA:** HAØDI, HAØDV, HAØLK. **HA2KRB:** Dezso, Csaba. **HA3KHC:** Arpao, Ferenc. **HA6KVB:** Laszlo, Ferenc. **HA9KOV:** Istvan, Csaba. **HV3SJ:** DJ3HJ, JA4CBP, DF2GX. **I1DSG** & I1ANF, I1GUB, I1GJC, I1PCT, I1RBP, I1UW, I1VVZ. **I2VTB,** & I2OLW, I2ECV. **I1KN** & I1LBH, I1FNX. **I4JEK** & I4DZ, I4-NLO, I4MFA, I4BRC, I4YGG, I4MNY, I4MEY, I4CKM, I4XTD, I4ZRP. **I4XZC** & I4IJY, I4GZN, I4DLS. **JA2YAB:** JA2JW, JA2IYJ, JA2JSF. **KA6GYL** & KA6GRI. **JA6YAP:** Kondo, Tsutsumi, Sato, Watanabe. **JA9YBA:** JH1GUO, JH2FKX, JH2SGU, JA3VEN, JA9DZS, JA9FSU, JA9GGH, JA9DPR, JA9GLL, JA9GOE. **JA1ZLO:** Club. **JA3YCZ:** JA2UET, JH2FQW, JA3OGE, JA3XGF, JH3CFG, JA8JLT. **JA2ZAP:** Club. **KP4AXM:** K1OTI, WB2POJ, K1DPG, Grant McCartney. **LZ2KKZ:** Christo, Danko, Penkoen. **LZ1KDP:** LZ1-A-508, LZ2H57, LZ1F84. LZØBFR: LZ1CQ, LZ1KX, LZ1-E-198. **OE7UU** & OE3GSA, OE4SZW. **OH2BM** & OH2BCP. **OH6DX** & OH6JP, OH6JW, OH6KN, OH6KT, OH6UM. **OH4RH** & OH4RF. **OH3EW** & OH2CG, OH2BNP. **OK3KAP:** OK3TFN, OK3CWU, OK3TPV, OK3TFM. **OK1KSO:** OK1WT, OK1AMF, OK1JWA, OK1ADH, OK1SF. **OK1KCP:** Seti, Taclar. OK1-KSL: OK1AQ, OK1AHG, OK1FAF. **OK1KRQ:** OK1IDK, OK1AYQ. **OK3KFO:** OK3TFH, OK3TCY. **ON6MP** & ON6NL, PAØMJK, PAØEDN, PAØMPM. PI1PT: van Kessel, Saalbrink, Kokee, Klok, Bloem. **PJ8YFQ:** K4YFQ, WB4VVF. **PY1EMM:** PY1TC, PY1ZBJ PY1ZAE, PY7APS, F3TA. **PY3AHS** & PY3APH, Jacobus. **SM5AOE** & SM6BJI. **SK6AB:** SM2CUD, SM6AGR, SM6CZZ, SM6-ASB, SM7EAN. **SK2AU:** SM2DQS, SM2DYS, SM2BFL, SM2FQG. **SM5AZU** & SMØMC, SMØATN. **SP6PZB:** SP6FAF, SP6FIH, SP9KRT: SP9HMF, SP9FKQ, SP9ZW. **SP6KDA:** Club. **SP3GEM:** Club. **SP2DVH:** Club. SP9KOT: SP9ZW, SP3FYI. **SP3GUA:** Club. **UK9AAN:** UA9AN, UA9AEN, UV9AB, UW9BY, RA9AFC, UA9-165516, UL7-02671. **UK9QAA:** UA9RR, UA9-134-11, RA9QBE, RA9QAQ, UA9QAX, UK9OAD: UA9OAD, UA9ODW. **UK9CCE:** UA9EI, UA9-154-940.**UKØAAB:** UAØABY, UAØAEE, UAØ-103294, UAØ-10340, UAØ-103344, UAØ-10343. **UKØFAA:** UAØEH, UAØFBE, UAØFBA, UAØFBW, UAØ 153-69, UAØ 153-79. **UKØSAA:** UAØSCF, RAØSCQ, UAØSBO. **UKØCBE:** Frolov, Turkin, Rubinshtein, Vlasov, Krivosheev. **VP2A:** WA2BCK, K2IGW. **VP2M:** VE7SV, K7JCA, VE7BD, W7EXM, VP2MF. **VP5WW:** WB4EYX, WB4-IAE, **W4EV/VP9** & WA1RFM. **WA1NZT** & K1YXK. **WA1STN** & WA1NNC. **W1MX:** WB2MZE, WA8WNU, WAØUCU. **WA1QNF** & WA1OCU. **W2HPF** & W2IIJ, WA2MBP, WA2UBM, WA3SWF. **K2BMI** & WB2RWY, WB2WID. **K2FL** & WA2POG, K3KNH. **W2YD** & WB2RKK, WA2UOO. **W2UI** & WA3KRD. **K2GXT:** WA3YBT, WA3YQE, WA2FQE. **K3GJD** & WA3VUQ, WA2KWB, WA3LQV, W3GHR. **W9SZR/3** & WB2EXK. **K3BW** & W3SS, K3JLK. **W3NX** & K3NEZ, W3DRD. **K3RLE** & WA3YHT. **WA4LZR:** W4LBT, W4LKG, WB4-HYN, WA4FCT, WB4JRM, WA4AZP, WB4OGW. **W4YWX** & W4BTZ, K4LRO. **WA4BTC** & WB4UZT. **WA4CTC** & WB4TPU. **K4WAR:** W6HGF, K7LSU, WB4GCL. **K4EBY** & K4LDR. WB5EPY & K5TSR. **WB5HVY** & WB5JWB, WA4BPK, WB5NSC, WB5NQS. **W5RRR:** W5LSZ, W5TFC. **W6ONV** & WA9-UCE. **W6PAA** & W6OWQ, WA6VEF, WB6AIN, KC6RS, OH1VR. **WB6KBK** & WA6PGB. **WB6GFJ** & WB6KRW, K6CQF, W6OAT. **W6KG** & W6DOD. **W6UA** & W6UM. **K3MNT/7** & WA1KKM, W5QQQ, WN7AGN, WA7TLK, WA7UQG. **W7VRO** & W7EKM, W7DQM, WA7ZWG. **K8YZW** & K8DVV. **WB8LDH** & W8LBM, WA8PPF, WB8RXN, WA8ILQ, WA1DXS, WB8DFK, W8CNL. **WB8-IAY** & WA8LXW, W8IMZ, B8VLG. WB8QJL & WB8NSF, WB8HNB, WB8-RMD. **W9LT** & WB9KTA, K9UF, K9UWA. **WA9PBK** & W9UDK, W9DOB, WB9NDP, WB9PUL, WA9LGT. **WB9BWU** & WA8RXM, WB9BJR, WA9AIB. **WA9IVL** & W9MLG, WA9JCO, WA9LZA. **K9KWK** & WA9FWY. **WØMYN** & WBØCMM, WBØHBS, WØMS. **WBØNHG** & WBØLEX, WBØHAD. **WØEEE:** WBØGQP, WB9FAT, Miller, Mery. **WØCIV:** WBØMHL, WBØKFM, WBØCQL, WAØUSW, KØYVI. **YO8KAN:** YO8ME, YO8MI, YO8GV, YO8AGZ, YO4KBJ: YO4WU, YO4CT. **YZ3TDX:** YZ3BU, YZ3EY. **YU4EXA** & YU1DIQ, YU1OIF, YZ4RS6633. **YZ1FJK:** Club. **YZ2CBM:** Grubisic, Koljatic. **ZL1AA:** ZL1ACG, ZL1ATX, ZL1TB. YZ1ABF: YU1OBH, YU1OBK, YU1OET, YU1OFJ, YU1NTG. 4U1ITU: K4IIF, OH2KH. **4M7AA:** Club. **ZS6ERB:** ZS6BNB, ZS6AJA, ZS6VA. **5LZA** & 5LZFT. **6D2MX:** XE2MX, W6DQX, WA6GLD. **UR2AAB:** Vlad, Al & Lenja. **UK2OAA:** Club. **UK2RBA:** UR2REN, UR2REO, UR2RDI, UR2FAB: Endel, Tonis, Margis, **UK6FAA:** UF601274, UF6FCO, UF601254. **UK7LAH:** UL7LEZ, UL7026133, UL7026177, UL7026233, RL7LAH. **UK7AAF:** Club. **UK7LAF:** UL7LBM, UL7026091, UL7026203. **UK7FAP:** UL7FAF, UL7FAE, UL702780. **UR2GKW:** UQ2ON, UQ2PJ, UQ2GBJ, UQ2OC. **UK2GAG:** Alex, Val, Alex. UK2GJB: UQ2MU, UQ2OP, UQ203791. **UK2BAS:** UP2PAJ, UP2-PAO, UP2038609. **UK2PAF:** UP2BCI, UP2BCR, UP2PAQ, UP2PAV. **UK2-PAT:** UP2BCW, UP2BCO, UP2BCT. **UK2BAV:** UP2NC, UP2MC, Jonas, Kestas. **UK2PBK:** UP2BCQ, UP20381518. **UK2BAB:** UP2BAF, UP2BBF, UP2CG, UP2038214. **UK6APA:** UA6APW, UA6101081, UA6APP, UA6ARD. **UK2AAO:** UV3CC, UA3147-19, UA3142303, UA3EAI, UA6150363, UA3ADM. **UK3ABB:** UW3BO, UV3CO, UW3FI. **UR3SAB:** UA3SCR, UA3SF, UA3SAQ, UA3151117, UA315125. **UK6LAZ:** UB50731024, UA6150262, UA6101152, UB5073470. **UK3AAC:** UA3HK, UA3AAH, UA9154139, RA3ACE, VA3AGX. **UK3ABO:** Club. **UK3QAA:** UA3QCR, UA3QAQ, UA3QDW. **UA3QAE:** UA3GO, UA3GBW, UA3GBJ, UA3QAX, UA3QDC, UA3RH. **UK3WAC:** Club. **UK4WAB:** Boris, Vlad, Gene. **UK3TBF:** Club. **UK3AAI:** Club. **UK3YAI:** Yuri, Alex, Nick. **UK3ACM:** Andrey, Andrey, Boris. **UK3MAA:** Club. **UK3EAA:** UA3EAL, UA3147146, UA3147115. **UK4LAC:** Yury, Harry. **UK3DBA:** UA3142141, UA3142531. **UK1WAA:** Boris, Igor, Oleg. **UK4AAA:** UW4AK, UA4156366, UA4156296. **UK6YAB:** UA610210, UA610280, UA6YAS. **UK6LKP:** UA6LLT, UA6150331, UA6150330. **UK6AAJ:** UA61011055, UA6101945, UA6101720. **UR4PAE:** Victor, Vlad, Mike. **UK4YAN:** UA4YAW, UA4YAL, UA409791. **UR3DCC:** UA3DBR, UA3DFT, UA3142370. **UK4PNZ:** Germ, Vlad. **UK5MAF:** UY5LK, UA6HZ, UB505922, UB5MDC, UB5MAK, UB5MCD. **UK5IAA:** Vlad, Valery, Valery. **UK5QBE:** Club. **UK5MAG:** UB5059610, UB5059611, UB50-5924. **UR5WAZ:** UB5068227, UB5WCW, UB5068398. **UK5EDB:** Vitaly, Vlad, Yury. **UK5VAD:** UB5VAO, UB5VBM, UB5VAI. **UK5IAI:** UA6LAC, UT-5AL, UB5073912. **UK5ZAK:** UB5ZAW, UB5ZAL, UB5069150. **UK5VAH:** Club. **UK5EDQ:** Club. **UK5LAS:** Club.

Multi-Operator, Multi-Transmitter

DK2BI: DK5WL, DK5WM, DK5WN, DK6WA, DK6WL, DK9WB, DC2WM. **DKØKX:** DJ1FG, DJ4PT, DJ6KA, DJ7YP, DK1AG, DK1QH, DK3RG, DK4QT, DK6QA, DK6QO, DK8BH, DK9QB, DL8OH, DL8QE. **DL0II:** DJ2YE, DJ5PE, DJ4TJ. **DL0PG:** DK2QL, DK3BJ, DJ9IE, DJ5KY, DJ9TQ, DK1QV, DK1FW, DJ1FC, DK7QC. **DL0WW:** DA2BD, DJ4OQ, DJ5NR, DK7FO, DK3ZC, DL3ZA, DL6NK, DL6OE, DB2FZ, DC6CK, DC6FF, DC6VD, DC8DE. **GB3MCG:** G3UKS, G4AYL, G3WGN, G3YPW, G3SJK, G3VCT, G4CDZ, G3RYV. **H3IKO:** HP1KC, HP1AC, HP1PM, HP1TS. **HB9H:** HB9LG, HB9AEB, HB9AGC, HB9AIB, HB9AIG, HB9AJM, HB9ALM, HB9ALX, HB9AQS, HB9AL, HB9BCD. **JA1YFL:** JR1GVZ, JE1TSD, JF1SMV, JG1CVR, JH2KKW, JA4JBT, JR6GD, JA0JCJ, JH1VSL, JH2NXZ, JF1HKX. **JH1YDT:** JH1BBT, JH1GNU, JH1AGH, JR1BSM, JH1KLA, JR1EYB, JR1FNR, JR1FVK. **JA3YDS:** JA3UOQ, JH3DDJ, JH3HRW, JR3PYW, JA4KPJ, JA9EBA, JA9FOR, JA9GLT, JA9OZG. **JA3YKC:** JA2VUP, JA3LDH, JA3ODC, JA3QJD, JA3REU, JA3RZN, JA3TRO, JA3UHW, JA3UPK, JH3AIU, JH3BBQ, JH3FZB, JH3GLP, JH3HBI, JH3-KWQ, JH3LIJ, JH3NYM, JH3PLE, JH3VES, JR3BVX, JR3WLK, JE3JBI, JE3KKC, JA5GZB. **JA6YTU:** JA6PEZ, JA6AD, JA6RCB, JA6QET, JH6AKT, JA6AAB, JA6BPA, JA6RLM, JA6BSM, JA6SVP, JA6QW, JA6ERR. **JA7YRR:** JA7CFB, JA7CLN, JA7CLX, JA7CXV. **K2CW/2** & W2LSX, K2BPP, K2JAO, K2JQR, W2BCU, WA3BNF, WB2BYW, W2FHN. **K3TGM:** WA3VVI. **K4CG:** K3WUW, WB8EAS, WB4BQX. **K6SEN:** W6PVB, WB6YBL, WB6PXP, K6BCE, K6SVL, W6BHY, K6SSN, WB6OLD. **KS6FF:** KS6DV, ZL1BTU, WS6FG, KS6FN. **LU1BAR/W3:** WA3UTA, K0CMF, LU2DX/W3. **OH1AA:** OH1NH, OH1NK, OH1NM, OH1LW, OH1IW, OH1SS, OH1SY, OH1XB, OH1ZK, OH1MD, OH1TV OH2FS, OH3NB, OH3ZC, OH6QY. **OH2AW:** OH2BR, OH2BAD, OH2BBM, OH2BCV, OH2BFS, OH2BGA, OH2BIA, OH2BMV, OH2BPB, OH2BPJ, OH2BPN, OH2EO, OH2KA, OH2VB, OH5XL. **PJ1AA:** PJ2ARL, PJ2BT, PJ2CL, PJ2CR, PJ2CW, PJ2DB, PJ2JW, PJ2MP, PJ2YD, PJ3BB, PJ9EE. **SK5AA:** SM5EUU, SM5FUG, SM5ELP, SM5FQS, SM5FYA, SM5FGU, SM5GRG, SM5FLO, SM5BVS, SM5FEX, SM5EDX, SM5FDD, SM5BFJ, SM5ACQ. **VX9A:** VE3MJ, VE3MR, VE3GMT, VE3IAA. **W2PV:** WA1ABV, W1GNC, W1GQO, WA1KID, K1OME, K1ZND, WA2AYC, WB2-OEU, WA2SPL. **WA2ZAA:** K2GL, W1GYE, K2KUR, K6SSS, W2SKE, K2UYG, W2GUH/0, W1HFB, K2BQO, WB2SQN, WA2DHF, W2GLM. **W3AU** & W3ZKH, K3EST, W3ADT, WA3AMH, W3IN, CX1EK/W4, W3AZD, WB2-JYM, WA3TAI. **W3BWZ:** K4CFB, W6AXX, WA3AFQ, WA3KSQ, WA3NGS, WN3ANE. **W3DHM:** WA3JLT. **W3FA:** W3ABC, W3GZQ, K3URZ. **W3FRY:** K3HTZ, K3DZB, W3KFK, WA3LNM, WA3RID, WA3JYB, WN3ZLU, WN3-ZLV. **W3GPE:** K3CY, K3OIO, K3WIV, WA3GUL, WA3PHO, WA3WIM, W3GM, W3GHM, WN3VYD, TI2JCC. **W3TV:** W3AOH, W3VW, K3GL. **W3WJD:** K3YUA, WA3LRO, W3BGN, W3DQG. **WA3ATX:** W5SCO, WA3COJ. **W4BVV:** K3ZNV, K4GKD, K5CIT, K6UA, K0DDA, WA3UHO, WB4BGV, WB4MRI, W3BOV, W4OCW. **W4MII:** WB2QHB, K5WTA. **W4OAW:** W4RVE, K4GTS. **W4USN:** W4DM, W4EZ, WA4JVO. **WA4YBV:** WB4GON, WB4GHF, WB4BAB. **WA5LES:** K5LZO, K5BGB, K5KYU, WB8FUO, WA5WCT, WA5ZNY. **WB5-DTX:** WA5UCT, W5BJA, W5ZSX, WB5OFP, K6MQG, WB5EEE, W5QWF. **WB5OOE:** WA5JMK, WB4JFZ/5, WB5IZN, W5TMN, K5KSI, WA5QXD, WB5KVM, WA5WWH. **W7SFA:** VE7ZZ/W7, K7HTZ, WA7OTT, CR6SM/W7, W7APN, W6BXO, WA7MEO. **WA8ZDF:** K3HZL, WA3GJU, W3GXF, K8HLR, K8IDE, K8EHU, K8RMK, IJMOI, WA8IUN, WA8VMO, WA8RWU, WA8YVR, WA8TBQ, W8KFL, WN8RIJ. **YZ2CBV:** YZ2RTG, YZ2RKE. **ZF1WW:** K3DPQ, K3JGI.

QRP *(from page 50)*

off the sides. Gain has not been measured, but judging from comparison with a dipole for receiving, it should be conservatively 4db. The small pieces of wood at both ends of the elements (see picture) support wire elements for 15 meters. Spacing is rather wide for optimum 15 meter operation, but it seems that the predictable gain is realized despite the use of #18 copper wire elements. A separate feedline and matching balun is used, and tuning procedures are the same as noted above for 20 meters. And the antenna really works on both bands. The first station that I called with the new beam on 20 meters was UA1PAA—I got him and had a solid ten minute QSO. That's not too impressive until you learn that I was running 700 miliwatts output at the time! That was my first QRPp DX and what a thrill! Over 20 countries have been worked with the minirig so far. I've really been bitten by the DX bug and gone QRO to four watts. The list stands at 54 countries now and WAC. And during a past SS contest, I racked up 27 QSO's in one hour —with 700 milliwatts. As far as stateside work is concerned, I'm thinking seriously of dropping to the 100 milliwatt level—it's too easy with 700 milliwatts and this beam. All I can say is that for about $9.00 and an afternoon's work, I've been working stations that I never dreamed of working with QRPp before. What's more, the antenna has held up beautifully under 60 mph gusting winds. And on top of that, this antenna is

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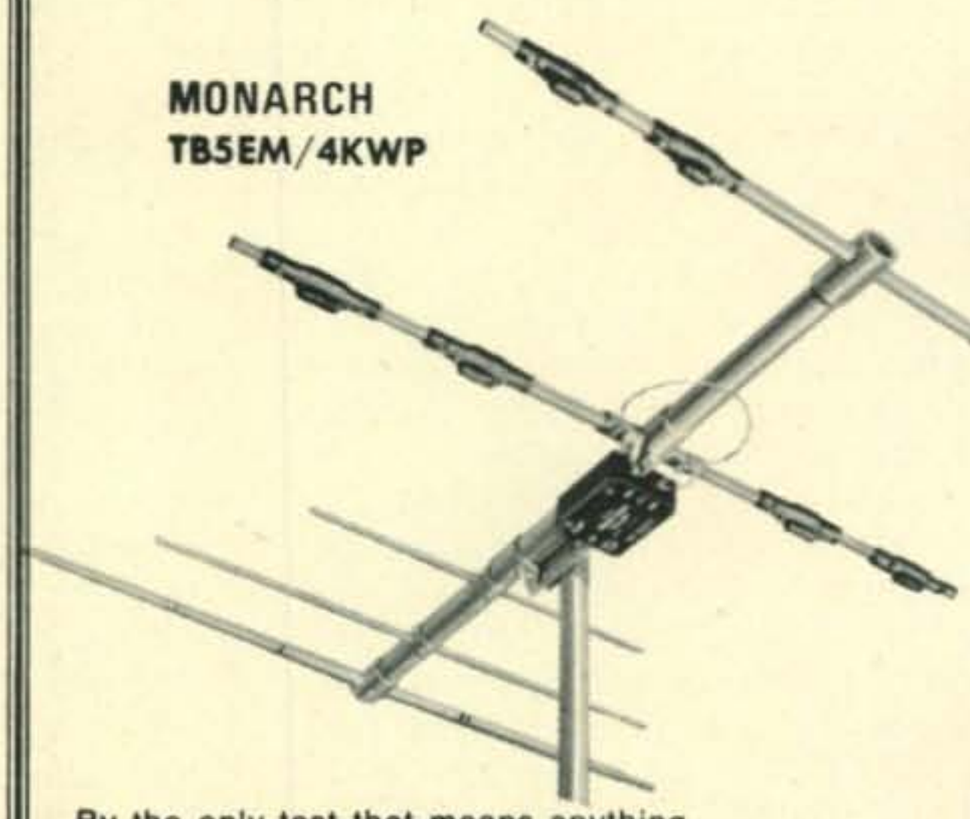

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beautiful—it looks like some huge prehistorical eagle landing on my mast with wings outstretched. If you are looking for a cheap, dependable, and effective antenna, this could be it.

73, Ade, K8EEG/Ø

Novice *(from page 50)*

(Novice) and Element 3 (General, Conditional, and Technician) class written exams; so look for new License Manuals incorporating the new material shortly. The new study guides suggest the areas the student should study, rather than listing many sample questions, without changing the scope of the exams to any appreciable extent.

We will be looking for your News and Views, suggestions, entries for our Photo Contestant any other material of interest to the young of heart. Send all mail to: Herbert S. Brier, W9EGQ, Novice Editor, CQ Magazine, 409 S. 14 St., Chesterton, Ind. 46304.

Antennas *(from page 48)*

"It is the new Swan SWR-3 Pocket s.w.r. meter," I said. "Good for a kilowatt below 21 MHz, and 500 watts up to 30 MHz. It is rated to 55 MHz."

Pendergast reached for a screwdriver and started to remove the case.

"You don't have to remove the cover. The schematic is very simple (fig. 8). It is an uncomplicated version of the strip-line s.w.r. device, made up on a printed circuit board. Basically, it is composed of two directional couplers, back to back. One coupler is used for forward readings, and the other for reverse readings. The basic design was described several years ago in *QST* magazine."

"That looks like just the instrument for Field Day," exclaimed Pendergast as he removed the cover and peered into the little box. After a moment, he replaced the cover.

"I'll drop down to *Friendly Bob's Place* and pick one up. There's not much left in amateur radio that you can get for ten bucks." He paused as he headed for the shack door.

"What do you think about the Sunspot Cycle?" he asked. "When is it starting to go up?"

"Well," I replied, "My uneducated guess is that we will see the sunspot count starting up in August, 1976. I won't know until some time after that date that I have guessed right, but I'll make a modest wager that August will be the turning point. But conditions won't magically improve right after that. But by fall of 1977, I would

think that things would be on the upswing, especially on 15 meters."

"How about 10 meters?" asked my friend.

"Maybe spring of 1978. That will give you plenty of time to get that new 10 meter beam working."

Pendergast smiled. "10 meters is my favorite band. Plenty of newly-licensed amateurs have never experienced the great DX days on 10 meters at the peak of the last sunspot cycle. They will have a big surprise and thrill in store for them."

"And what about the 11 meter CB band?" I asked. "What do you think will happen to *that* when the sunspot count goes up?"

Pendergast shuddered. "I remember it about 10 years ago when there were fewer CBers than there are now. It was a madhouse then. I can't imagine how horrible it will be in a few years. I hope some of the smart, savvy CBers will become amateurs before that unhappy time arrives." ■

In Focus *(from page 53)*

not being able to adjust their non-existent diaphragms!

Faster films like Kodak Tri-X Pan and Polaroid's 107 require some means of reducing the amount of light flux reaching the film.

I'll discuss exposure control for these films, film speeds, and further info on close-up lenses in upcoming columns. In the meantime, go ahead and TRY SOMETHING!

Worthwhile Photographic Book

If there are any professional photographers out there among you slow scanners — or advanced amateur photographers, Kodak has a new book out called *Kodak Professional Photoguide.* It is also called *Kodak Publication R-28,* sells for about $8.50, and believe me, it's worth twice the price! It contains every kind of data you could possibly wish for in all phases of B&W and color photography. It covers Films, Exposure, Filters, Flash, Camera Lenses and Perspective, and even contains a sample gray scale and a color chart, plus eight built-in circular slide rule calculators.

Free Trip To Naples?

Naples, Florida, that is, where Bob Weinig, K4FZ holds forth. I'm sure that not only the equipment but the fine cabinet space available will be the envy of everyone seeing the picture (fig. 5) of Bob's beautifully equipped "shack"! As you can see in the other photo (fig. 6) Bob has engineered a nifty system for televising flat copy material. The three curio picture lights used to illuminate the copy are controlled by a solid state dimmer.

Incidentally, Bob's "menu board" has vertical angle pieces forming slots into which cards 8 inches wide are slipped. The camera track consists of two ½ inch aluminum angles. The camera rolls back and forth on plastic wheels.

Every time I work K4FZ, he's trying something new. Always seeking ways to create more interesting pictures. His latest project is a system for projecting slides onto a translucent screen between the camera and the slide projector. Sounds great Bob, send us some more pictures!

Any More SWV's Out There?

From Uxbridge, Mass. comes a neat card signed by Bill Smith who is a non-ham SSTV viewer. Bill's well-equipped set-up includes a Robot 70A monitor, Drake R4C and SPR-4 receivers, and, a two-element beam at 70 feet! Although Bill describes himself as a short wave listener, I have a feeling that he's a ham at heart. Come on Bill, find someone to help you get a ticket, we need you!

News And Views From Europe

Looking for an OK contact? Josef Psota, of Kosice, is one of Czechoslovakia's active slow scanners. Josef builds all of his own equipment. His homebrewed transceiver uses 30 transistors and 7 tubes. He pumps 75 watts into a dipole suspended 40 meters off the ground between two buildings.

Take a look at fig. 7 showing Josef's homebrewed camera. A very neat job in all respects. The camera circuitry uses 23 transistors. Yes, his monitor is homebrewed too! Thanks to Mike Ludkiewicz, W1DGJ, for the photo and info on OK3ZAS's gear.

From Denmark, an oldie but goodie to wind up this month's column. It was a long time ago that T. I. Pedersen, OZ4IP sent me the accompanying picture (fig. 8) of his "mobile station", but I still get a kick out of it. I hope you will too!

Final-Final

Please keep those letters and pictures coming my way. They are what make this column interesting for your friends around the World, they DO want to know what you're doing even if the band conditions are poor most of the time. As it says in the call-books, W2DD lives at 2112 Turk Hill Road, Fairport, N.Y. 14450.

73, Bill, W2DD

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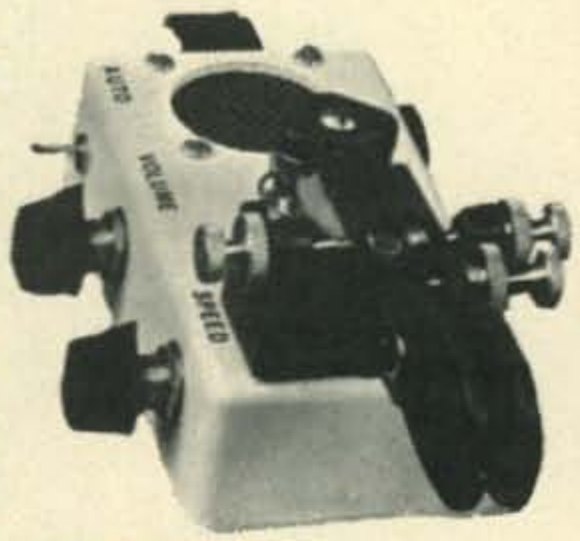

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DX *(from page 58)*

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TU2GA—Via K9KXA
VE1ASJ/XJ1—To K1RQF
VP2EEI—c/o K1LPA
VP2KN—For contacts after Jan. 1, 1976, via W7OK
VP2MEO—To VE3CZV
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ZK2AQ—For WPX Contest period, March, 1976, QSL to Bill Rindone, WB7ABK
ZL3LN/C—To ZL4BA
3D2KG—c/o YASME Foundation, P.O. Box 2025, Castro Valley, CA 94546
5X5NK—Via DL1YW
8P6HN—To W0OIR
9L1BH—c/o SM3CXS
9L3JM—Via W4BAA
9M6MA—To JA1KLT
9M8HB—c/o HB9XJ

73, John, K4IIF

Contest Calendar *(from page 61)*

Scoring: One point per QSO and one point for each QTC reported.

Multiplier: For non-Europeans, number of EU stations worked on each band. Europeans will use the ARRL list and call areas as follows: JA, PY, VE/VO, VK, W/K, ZL, ZS, UA9/UA0. In addition the multiplier on 3.5 may be multiplied by 4, on 7 MHz by 3, and on 14/21/28 by 2.

Final Score: Total QSO points, plus QTC points, times the sum total multiplier from all bands.

QTC Traffic: Additional QSO points may be realized by reporting a QTC. This is a report of a QSO you have made earlier in the contest and later sent back to a European station.

The general idea being that after a number of EU stations have been worked a list of these can be reported back to another EU station. One point may be earned for each QSO reported. A QTC can only be sent from a non-European to a European station.

A QTC contains the time, call and QSO number of the station being reported. i.e.: 1300/DK2BI/134. This means that at 1300 GMT you worked DK2BI and received his number 134. It may be reported only once and not back to the originating station.

A maximum of 10 QTC's to the same station are permitted, and the same station worked several times to complete this quota. Only the original contact has QSO point value.

Keep a uniform list of QTC's sent. QTC 3/7 indicates that this is the 3rd series and that 7 QSO's are now being reported.

Awards: Certificates to the highest scoring stations in each country and call areas listed in the multiplier. Continental leaders and stations have at least half the score of the continental leaders will also be awarded.

Disqualification: Violation of the rules of the contest, or unsportsmanship conduct, or taking credit for excessive duplicate contacts or multipliers will be deemed cause for disqualification. Decision of the Committee is final.

It is suggested that you use the official log and summary forms. A s.a.s.e. with sufficient IRC's to the DARC will get you a supply. (W/K and VE stations can send their request to WA3KWD, Hartwin E. Weiss, 323 North Street, Millersburg, PA 17061 or to W1WY. Figure 40 contacts to the page if you make your own, and use a separate sheet for each band.

Mailing deadline for logs is Sept. 15th for C.W. and Oct. 15th for Phone. To the DARC Contest Committee, D-895 Kaufbeuren, P.O. Box 262, West Germany.

European Country List

C31 — CT1 — CT2 — DL, DM — EA — EA6 — EI — F — FC — G — GC Guer — GC Jer — GD — GI — GM — GM Shetland — GW — HA — HB9 — HBO — HV — I — IS — IT — JW Baer — JW — JX — LA — LX — LZ — M1 — OE — OH — OHO — OJO — OK — ON — OY — OZ — PA — SM — SV — SV Crete — SV Rhodes — TA1 — TF — UA1346 — UA2 — UB5 — UC2 — UO5 — UN1 — UP 2 — UQ2 — UR2 — UA Franz Josef Land — YO — YU — ZA — ZB2 — 3A — 4U1 — 9H1.

Propagation *(from page 63)*

Far East	14-16 (1) 20-23 (1)	07-10 (2) 10-13 (1) 21-23 (1) 23-00 (2) 00-02 (3) 02-04 (2) 04-07 (1)	02-03 (1) 03-04 (2) 04-05 (3) 05-06 (2) 06-07 (1)	03-06 (1)
South Pacific & New Zealand	13-15 (1) 15-17 (2) 17-19 (3) 19-20 (2) 20-21 (1)	02-07 (1) 07-10 (2) 10-16 (1) 16-18 (2) 18-19 (3) 19-22 (4) 00-02 (2)	23-01 (1) 01-02 (2) 02-06 (3) 06-07 (2) 07-08 (1)	00-02 (1) 02-06 (2) 06-07 (1) 02-05 (1)*
Australasia	15-18 (1) 18-21 (2) 21-22 (1)	19-21 (1) 21-22 (2) 22-00 (3) 00-01 (2) 01-07 (1) 07-09 (2) 09-13 (1) 13-15 (2) 15-16 (1)	00-01 (1) 01-04 (2) 04-06 (3) 06-07 (2) 07-08 (1)	02-05 (1) 05-06 (2) 06-07 (1) 04-06 (1)*
Caribbean, Central America & Northern Countries of South America	15-18 (1)** 10-13 (1) 13-15 (2) 15-18 (3) 18-19 (2) 19-20 (1)	06-07 (1) 07-10 (3) 10-15 (2) 15-18 (3) 18-21 (4) 21-22 (3) 22-23 (2) 23-02 (1)	19-21 (1) 21-22 (2) 22-03 (3) 03-05 (2) 05-06 (1)	20-21 (1) 21-03 (2) 03-05 (1) 23-04 (1)*
Peru, Bolivia, Paraguay, Brazil, Chile, Argentina & Uruguay	12-16 (1)** 10-12 (1) 12-13 (2) 13-15 (3) 15-17 (2) 17-18 (1)	05-07 (1) 07-09 (2) 09-15 (1) 15-17 (2) 17-18 (3) 18-19 (4) 19-20 (3) 20-22 (2) 22-00 (1)	20-21 (1) 21-23 (2) 23-01 (1) 01-03 (2) 03-04 (1)	22-03 (1) 00-02 (1)*
McMurdo Sound, Antarctica	16-18 (1)	17-20 (1) 20-23 (2) 23-01 (1) 07-09 (1)	21-23 (1) 02-03 (1) 03-06 (2) 06-07 (1)	04-06 (1)

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WANTED: Yaesu FT-401B or equivelent Yaesue equipment, Must be Top-notch condition. Price range $400.00 - $500.00. For Sale: HW-16, Gh-10BVFO. Slight repairs needed. Contact Bruce Wade 6060 N. Sunny Pl Rd. Milwaukee Wi. 53209. (414)228-9630.

SX-100 nice, manual, $125. Wanted SX-122 w/crystal calibrator, manual. HW-16 & HG-10 also SR-150 xceiver. R. Voelker, 101-23 Lefferts Blvd. Richmond Hill NY 11419.

HEATH IG-28 Color Bar Generator, Professionally wired and tested. New $115. postpaid in U.S.A. G. Alfred Dodds, 874 Pepperwood Lane Brunswick, Oh. 44212.

REGENCY HR-2B new in factory box cost $229 first $198. takes it, G.E. Mobile monitor Rec 12 vdc very clean w/manual $20. K6KZT 2255 Alexander Ave. Los Osos, Ca. 93402.

RECEIVER, Hammarlund HQ-180, $250, Dick Kelly, W6BKY, Box 1633, Palo Alto, Ca. 94302.

WANTED SIDEBAND/SELECTIVITY switch new or used for HQ170 or HQ180. E.W. Klein KP4UW, P.O. Box 1773, San Juan, PR 00903.

WANTED: Heathkit HW-22, Outside should be Clean, but unit need not work. State price and condition. John F. Werner, WB8IPG, 23616 Falmouth Drive, Warren, Mi. 48089.

SALE: Galaxy V MK3, AC400 Pwr. supply, SC-1 Spkr, RV-1 VFO, Cal 35 Calib, F-3 Filter FM Strickhausen, 2931 Central Park no. 38 Topeka, KS 66611.

TONE BURST Encoder for HW-202, Never needed it. $20. Also HW-202 2 M Xcvr Mint 16/76, 34/94, 52/52, 94/94 $170 firm. K3MND J. Myers, 408 Tasker St., Ridley Park PA 19078. 215-586-2334.

SELL OR TRADE: Mint Factory Built Mainline TTL2 for 2 meter Rig or receiver. C. Kaufman, WA0GUN, 3734 South Poplar St. Denver Co. 80237.

DISABLED NOVICE would really appreciate donated or any used Ham Equipment and parts back issues of CQ, QST, 73, Ham Radio. I can do my own repair work. Anything or help would be really appreciated. Eward E. Maher, 489 Grand Blvd. Brentwood, N.Y. 11717. 516-231-5077.

YAESU FT224 ZM FM W/6 Channels mint $240, 1/4 wave magnet mount ant. $15, Ringo Ranger W/50 RG8U $22. Argonaut SN.2024 Mint $235, 405 Linear Amp. $125, Both for $350. All with manuals, you ship WA4MSD, 2808 Starnes Rd., Charlotte, NC 28214.

FOR SALE: Viking II, $20. Viking Mobile Xmtr, $10. L&W Double Deluxe 6 & 2 meter Xmtr $10. B&W TR Switch $5. RME 69 Good condx. $80. S. Olster, W1HDI, 6-H Stony Run, Kingston, N.Y. 12401.

WANTED: Heath 2 meter transceiver with crystals in good condx. Tom Dorneack, 2515 College, Downers Grove, IL 60515.

WANTED: Heath Electronic thermometer in good conx. Tom Dornback, K9MKX, 2515 College Rd. Downers Grove, IL 60515.

FIRST ANNUAL ELMIRA HAMFEST, Sept. 25, For details, write WA2SMM, 320 W. Ave., Elmira, N.Y. 14904.

WANTED: Heathkit SB-640 external LNO in good Condx. Drake M. Peddie, 5027 Braesheather, Houston, Tx. 77096.

WANTED: Antique radios in good condx. Send price and picture if available. Drake M. Peddie, 5027 Braesheather, Houston, Tx. 77096.

WANTED: SW-3 Also ARRL 8th Edition H.B. Give Price and details. John H. Alford, 3184 Lockmoor Lane, Dallas, Tx. 75220.

FERRITE BEADS: Lowest Price in the country. 15 for $1.00. With spec. Sheets T. Gorlin, 4829 Buchanan St., Hollywood, Fl. 33021.

WANTED: Bearcat 101 Scanner; Regency AR-2 or Heath HA-202; Protax 375; Eico 667 Heath SB-610. Sell: Heath HP-13 DC Supply $50. Forrest Kauppi, Rt. 1, Box 171, Gilbert Mn. 55741.

BUCHERS BOOKS FOR SALE. Vac tubes in wireless communication 1918. Wireless experimenters manual 1920. Practical Wireless Telegraphy 1917. Price $10. each FOB. M.J. Douglas, 2254 Pepper Dr., Concord, Ca. 94520.

COLLINS 75A-4 $275 Heath DX-60A, HG-10B VFO, Relay $100. WB6HBX Russ Forsberg 4334 Mt. Jeffers Ave. San Diego Ca. 92117.

TH6DXX FOR SALE: Now in use. Excellent. $100.00 firm. Also 4-1000 A Linear parts cheap. Contact WA2FKF, Box 236, Waldwick N.J. 07463.

FOR SALE: SB-34 Transceiver in excellent condition. Just returned from factory service dept. Manuals. $250. Al Baisch, WA6EFT, 33962 Pequito Dr., Dana Point Ca. 92629.

WANTED: Any ARRL publications any editions Magazines of all types (electronic and ham orientated). Contact Loran Joly, 432 Central Ave. Mora, Mn. 55051.

WANTED: "S" meter for S36 S37 SX28A, also Rider no. 23. Sell Riders 6 thru 18 inc. J. A. Call 1876 E. 2990 So. S.L.C. Ut. 84106.

WANTED: Magnum Six for Drake T-4X. Don Bishop, 11655 Logan, Northglenn, Co. 80233

FOR SALE: Collins 200 Hz. Crystal Filter plug in. 2 Vertical Antennas 14 AVQ. Paul Wise Route 6 Rogers Ark. 72756.

WANTED: Directories of US Signal Corps. Equipt. TM11-487 TM11-487A, TM11-487C, TM11-487H, TM11-487I. I.G. Mant, G8AVJ, 28 Welbourne Rd., Liverpool L166AJ England UK.

MODEL 19 Teletype $75., M-15 $35., M-14 $30. WA3UFU, 1132 1/2 Tilghman St., Allentown, Pa. 18102.

FOR SALE: Heath DX-60 with HG-10 VFO, $95; F. Kurz, 2711 W. 29th St., Zion IL 60099.

WANTED: Trap Verticle Antenna, Heath HDP21A Mic, Swan Speaker or Speaker/Phone Patch. Swan Wattmeter or Watt/SWR, and Heath Line Voltage Monitor. T. Coddington, 7825 Scotts Valley Rd. Lakeport, Ca. 95453.

VIKING CHALLENGER Xmter 80-10 and 11 $35. Gonset G.66p. Rcvr. with Power supply $35. WB/VNR (213)346-5871.

FOR SALE: SB-220 Filament transformer, brand new. $40.00 plus postage. Alex Desmeules, VE2AFC, P.O. Box 382, Quebec 4, Que. G1R 4R2 Canada.

SWAP QST, CQ, HR, 73. Personal and club collections. My need/spares list for yours and/or SASE. Want SW-3 bottom plate and coils. Bob May, Box 30, Jonesboro, Tn. 37659.

MOD TCS-4 Radio Equip. Type COL-52245 Transmitter with pwr cable and schemetic, 1944 vintage, SASE for info or First $35. M.O. plus $5. for shipping gets it. W5OBB, 1701 Westside Dr., Sherman, Tx. 75090.

WANTED: Quality gen-coverage receiver - Ameco all band preamplifier, Hammarlund HC10 Slices. P.K. Outlaw, Rte. 1 Box 60, Bethune, SC 29009.

CLEGG 22er AM tx out board FM mod Al $165.00 WA2CMO N.J. (609-693-8754.

FREE CATALOG. LEDS, Strobe Lights, UARTS, Memories, RF Transistor, Microphones, IC's, Relays, Ultrasonic Devices, Precision Trimmer Capacitors, Digital Thermometers, Unique Components. Chaney's, Box 15431, Lakewood, Co. 80215.

CUSTOM EMBROIDERED Club Emblems. Your design, low minimum, informational booklet, Write Emblems, Dep. 10F, Littleton, New Hampshire 03561.

DC-DC Converter power supply, brand new manufacrurers surplus, complete with cables. Input: 12 VDC @ 32 A; Outputs: 800 VDC @ 0.253 A, 300 VDC @ 0.155 A, -100 VDC @ 0.060 A, 12 VDC @ 5 A. Ideal for 200 watt PEP SSB transceivers. $50 plus shipping. W2EKB, 348 Bortons Mill Road, Cherry Hill, N.J. 08034.

TECH MANUALS for Govt. surplus gear -- $6.50 each: SP-600JX, URM-25D, SG-3/U, TS-173/UR, TS-174/U, LM-21, OS-8B/U. Thousands more available. Send 50 cents (coin) for 22-page list. W3IHD, 7218 Roanne Drive, Washington, DC 20021.

TRIPOLE New! 80-6 plus 160 antenna! 80 to 120 feet. Guaranteed. $54.95 kit. Sase for information. Universal Radio Co. Dept C2, Box 26041, El Paso, TX 79926.

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LOOKING for used gear? Buyers and Sellers radio brokerage has the equipment you want at the prices you want to pay. Call our HAM GEAR HOTLINE: 617-536-8777, Weekdays 9-5 EST.

MEDICAL: Any licensed amateur radio operator in the medical or paramedical field shoud join MARCO (Medical Radio Council). Contact: Stan Carp. M.D., K1EEG, 44 Main St., Saugus, MA 01906. (617) 233-1234.

QSL CARDS- Something completely different Nothing even close to it on the market! Samples: 25 cents W5UTT, Box 1171E, Garland, TX 75040.

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LEARN CODE in a few days with audio reflex method of teaching letters, numbers, punctuation. One hour cassette only $7.00. Television Diagnostic repair course by master technicians. Lessons $6.00 each. Optional matching cassette tape $6.00. Send for first lesson and master index. Guardian Electronics 20 East Main, Ramsey, N.J. 07446.

"HAMFEST" - July 25, Stark County Fair Grounds, Canton, Oh. Call 216-455-4449 or write WA8SHP, Box 3 Sandyville, Oh. 44671 for information.

FOR SALE: Brand new Swan-160X complete with 117XC power supply-speaker combination. Never plugged in. $500 or best offer. W0MEK, Pisek, ND 58273. 701-284-6291.

BUY-SELL-TRADE. Write for free mailer, Give name address, call letters, complete stock of major brands new and reconditioned equipment. Call us for best deals. We buy Collins, Drake, Swan, Etc. SSB & FM. Associated Radio 8012 Conser, Overland Park, Ks. 66204 913-381-5901.

WYOMING RANCH LAND. Wild Horses, antalope, deer, elk. 10 acres $30 down, $30 month. Owner - K6ICS, Mike Gauthier, 9550Q Gallatin, Downey, Ca. 90240.

WANTED small prop pitch motor. Will pay cash or trade large prop pitch motor. Call collect to Al Hart 313-585-0600.

TS520 Never Used with CW filter and external VFO. AC only $675. Heath desk microphone mint $400. Linear $175. W6TC 415-584-4649.

WANTED: Specs, Schematic Diagrams for Zenith Model B835R Table AM & FM Radio. S.L. Ballinger, WN2BSS, 102 Garden St. Poughkeepsie, N.Y. 12601.

WANT: Riders Vol. 23. SX88 SX73. H.E. Parr Clifton Hill, MO 65422.

NEED manual or schematic for Receiver R-105A/ARR-15. A.J. Mony, Rt. 2, Douglasville, GA 30135.

WANTED: Murch Ultimate Transmatch. Must be in at least mint condition. Michael Povman 147-04 75 Ave. Flushing, N.Y. 11367.

COLLINS 75S1 with Waters Notch Filter, 32S1 with 516F2 Power Supply $750. Wanted - Triex or Aeromotor Tower. F.P. Heinemann, Brockway Landing, Lyme Ct. 06371.

TWO OLD RADIOS: Freshman Masterpiece and Motorola International Short Wave. Sell only to collector and one who can come see. John, WB9OEQ, 6050 North Oakley, Chicago IL 60659.

WANTED: SB-102 C.W. Filter, Sell HP-13A DC Supply. $40. Lamplin 105-B Freq. mtr. $75.00, P.J. Serafinas, 925 Coleridge Rd. Baltimore, Md. 21229.

WANTED: Extra Heavy Duty Antenna Rotor. Ed Lubowicki, 543 Middlesex Ave., Metuchen N.J. 08840.

GONSET COMMUNICATOR III - 6 meters w/xtals $69. Homebrew Pwr Supply Heathkit SB 101 etc, $20. Above plus shipping. WB5 FDT Bob Via, 6827 Spring Hurst, San Antonio, TX 78249.

RADIO AND ELECTRONIC Collector Magazine. Collectors of antique radio and related items, please note. Subscriptions $2.50 per year, trial 3 issues $1.00. RAECM, 2374 Queenston Rd., Cleveland Heights, OH 44118

NO DX QSLs? Try ham sentences in 54 languages on your card. It works! K3CHP's DX QSL Guide, $3.95. Joe Mikuckis, 6913 Furman Pkwy. Riverdale, MD 20840.

WANT 250th's preferable Eimac unused with ribbed anodes. Also want a copy of Keen's "Wireless Direction Finding" in good condition, and a cipy of sixth edition NAB Handbook. Paul Rockwell, W3AFM, 5800 Hillburne Way, Chevy Chase, Md. 20015.

FOR SALE: as set, KWS-1, 75A4, SC-101 Control 68Y-1 Antenna Selector Unit. $800. C.A. Gobs, Rt. 1 Box 85B, Leesburg, Va. 22075.

FOR SALE: QST/73/CQ/HR SASE for list. E.D. Guimares Jr., RFD 2 Box 480 Middleboro, MA 02346.

WANTED: Quality gen-coverage receiver, Hammarlund HC 10 slicer- Ameco tunable preamplifier. P.K. Outlaw, Rt. 1 Box 60. Bethume, S.C. 29009.

SELL: 3600-0-3600 volt 1 amp plate xfmr with 110/220 primary $40. Want: Johnson 250 W Matchbox, Vacuum Variables: 1500 pf, 2000 pf. Paul Bittner, 304 W. 17th St., Grand Island, NE 68801.

WANTED: Collins 30L1 Linear. Galaxy V Mark 2 Transceiver. Ralph Sieloff, RD 2, Lagrangeville, N.Y. 12540.

SORENSON model OSB6-15 DC power supply 5 to 9 volts @ 15 amps. Brand new, with schematic. Cost over $400, sale priced at $175.00. G. Alfred Dodds, P.O. Box 25, Brunswick, OH 44212.

GOVERNMENT SURPLUS Communications equipment. If you haven't received our new catalog, write for your free copy, now! Colonel Wayne D. Russell, 9410 Walhampton, Louisville, Ky. 40222.

SWAP: Three VHF-ARC-5 xmtrs 50, 144, 220 mHz w/pwr supply-modulator for what-have-you? R. Voelker-WA2PCL, 101-23 Lefferts Blvd. Richmond Hill, NY 11419.

WANTED: Ranger, Navigator, AF67 or SF68. John H. Guthrie, W3SJL, St. Marys, Pa. 15857.

Announcements *(from page 12)*

quirements of fossil fuel for New England. For further information contact: Toward Tomorrow Fair, 200 Hills House North, University of Massachusetts, Amherst, MA 01002, 413-545-0474.

● **Traverse City, MI** — The Cherryland Amateur Radio Club will award an attractive certificate during the Centenial year of 1976, to any Amateur Station that works the Club Station WB8VKB, or uses our club repeater WR8AEN, or who works five of our Cherryland Radio Club Members, July 4th to the 10th. Rules are simple. To receive a Certificate simply confirm your QSO with your QSL card, along with a stamped 8½ by 11 envelope and enclose 50 cents to W8GI, Box 141,Kingsley, MI 49649.

● **Honolulu HI** — The Honolulu Amateur Radio Club will hold its Hamfest/Swapmeet on July 3 and 4 at the Kaimuki High School, 2707 Kaimuki Ave., Honolulu between the hours of 0800 AM and 3 PM. Charges per stall will be $2.00. Activities include a Hidden Transmitter Hunt. Registration is $1.00 per vehicle. The HARC Bicentennial Dinner will be held at the Flamingo Chuckwagon Restaurant, 1015 Kapiolani Blvd. Activities include displays and prizes. Cost per person is $10.00. For additional information and participation write George Stillman, P.O. Box 7111, Honolulu, HA 96821.

● **Charleston, SC** — The Charles Towne Hamfest will be held at the Gaillard Municipal Auditorium on July 11th. Registration is $2.00 which includes a door prize ticket. Activities include an indoor fleamarket, displays, homebrew contest, cw copying contest, historic tours, and a special program on the Marconi Wells Fleet Wireless Station. Saturday activities include QCWA, MARS, S.C. SSB Net Banquet, and a hidden xmtr hunt. Motel accomodations available at reduced rates - reservations urged. Talk in on 34/94 and 3915. For further information write Charles Towne Hamfest, Box 4555, Charleston, S.C. 29405.

● **Cary NC** — The Fourth annual Midsummer Swapfest will be sponsored by the Cary Amateur Radio Club, Saturday July 17, 9:00 AM thru 3.00 PM, at the Lion's Club Shelter. Registration and informal buying/selling/swapping/eyeballing/relaxing 9:00 - 11:30. Registration $1.50. Dealers welcome. Talk in on 146.28/88 146.04/64, 146.52. Info, SASE to: CARC, Box 53, Cary, NC 27511.

● **Swampscott, MA** — The Federation of Eastern Massachusetts Amateur Radio Associations are now requesting nominations for the "Ham of the Year" award. Only amateurs in the first call district are eligible and the winner will be selected by who has performed an outstanding public service. Nominating letters should include the candidate's name and a complete description of the service performed. Letters shall be sent to the Chairman of the FEMARA Awards Committee, 28 Forest Ave. Swampscott, Ma. 01907.

● **Alpine, TX** — Stolen from Dick Ellis, W5YCK, 104 West Avenue A. Alpine, Texas 79830, one Heath HW 202, Series 00316 Transceiver. Modified: BNC Antenna Connector, Scanner with LEDs over top (extra) barswitch. Three switches to left not connected. Right switch turns scanner on/off. Wires were cut at back panel. Phone: 915-837-3728

Our Readers Say *(from page 7)*

to the trend we've seen in the mechanics magazines just before the amateur radio publications.

One of your letter writers offered that he would rather see the handicapped articles elsewhere than in *CQ*. I guess his meaning was as you took it, but my first impression was that he'd like to see more notice taken on that topic in other places as well, not just here. Oh, well; maybe I'd just as soon have repeater articles limited to *Ham Radio*. That's the only major amateur publication I don't subscribe to. I'm a low band man myself, but 2M FM is a part of today's ham radio, and it's what makes my own local club, Egyptian RC in Granite City, IL, the fireball outfit that it is. There must be room for all of us; and if I can help a 2 meter Tech. while another ham can help the handicapped, maybe we've both done more to serve than just stand and wait.

H. Church, WØKXP
Lebanon, IL

Heisseluft Erratum

Editor, *CQ*:

What a wonderful job you did of publishing my latest work! The layout of the April article is well done, and contributes to the ease with which the reader can study the material.

Unfortunately, small but significant errors appear in Figure 3. Not only were the lables on the ordinates interchanged, but so too were the words "cold" and "warm". Also, the (A) is missing from the top figure.

Emil Heisseluft
Grossmaul-an Der Conau , Austria

CQ welcomes readers comments. If you have any comments pro or con please let us know. Address your letters to Our Readers Say, CQ Magazine, 14 Vanderventer Ave., Port Washington, N.Y. 11050.

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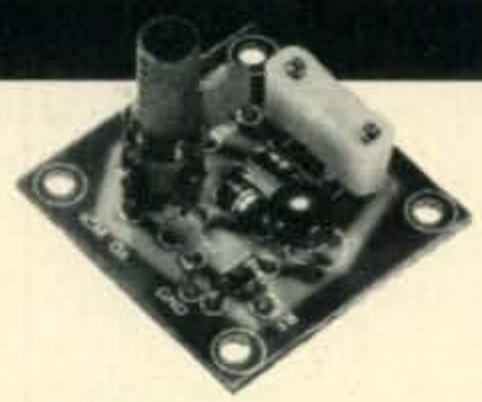

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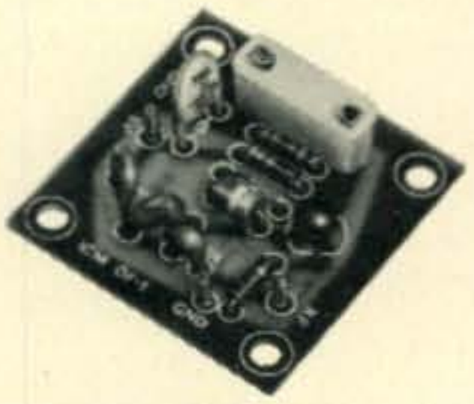

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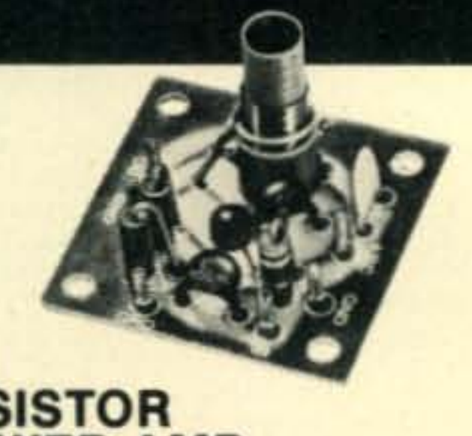

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A single tuned output amplifier designed to follow the OX or OF-1 oscillator. Outputs up to 200 mw, depending on frequency and voltage. Amplifier can be amplitude modulated. 3 to 30 MHz, Cat. No. 035104

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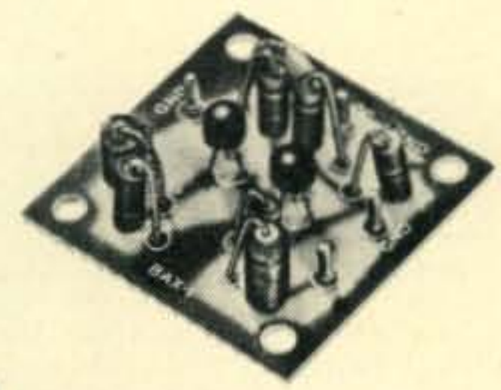

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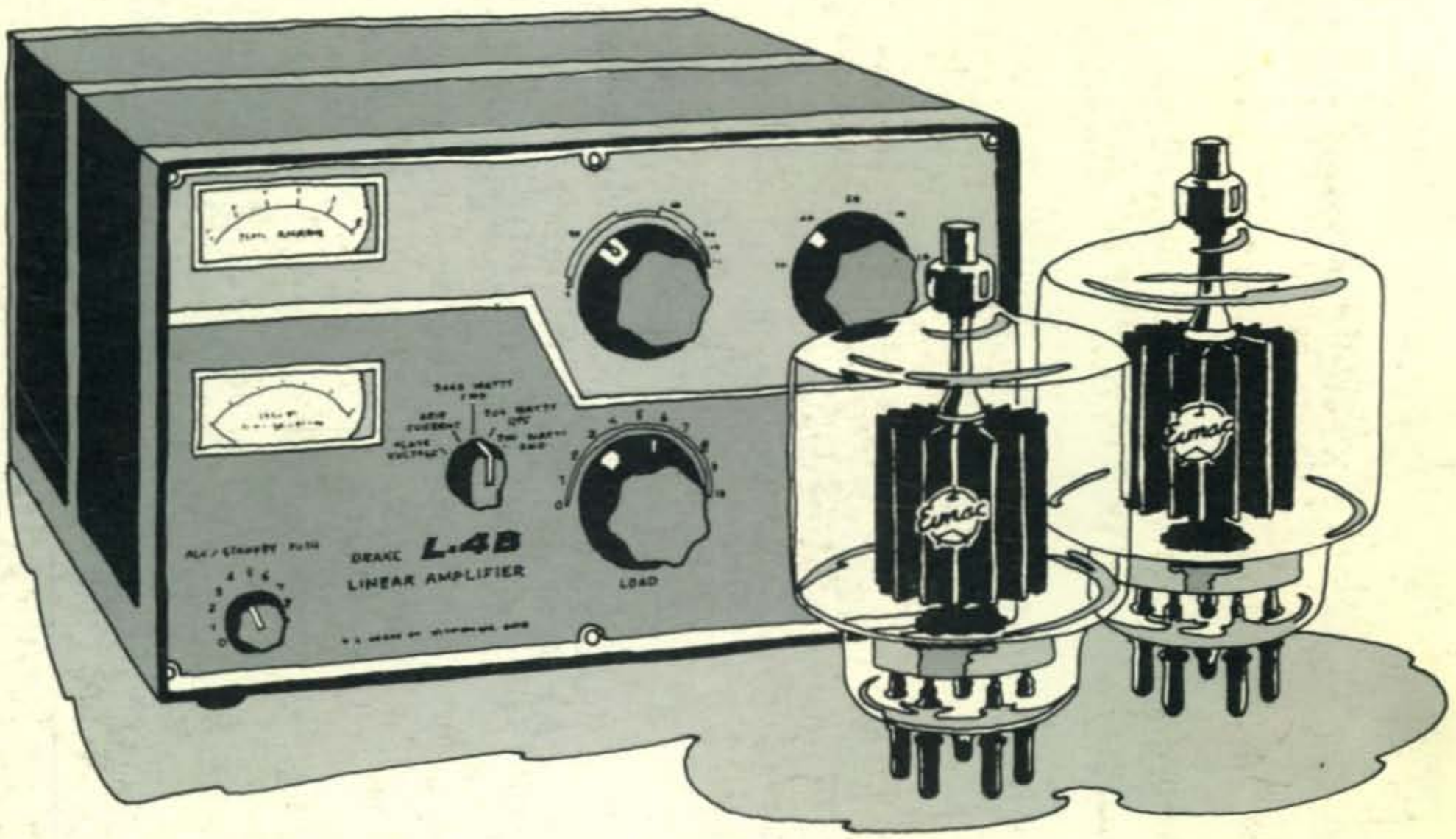

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Our point? Drake doesn't keep it a secret that the L-4B's high efficiency class B grounded grid circuit uses EIMAC 3-500Z zero bias triodes. EIMAC's performance reputation is a much publicized plus. Use of the 3-500Zs simplifies the circuitry, provides 1,000 watts plate dissipation and turns driving power into maximum output power.

To find out more about the reason Drake's first choice is EIMAC, or to ask about our design flexibility to meet individual applications, drop us a line or call. We have no secrets.

Contact Varian, EIMAC Division, 301 Industrial Way, San Carlos, California 94070, (415) 592-1221. Or any of the more than 30 Varian Electron Device Group Sales offices throughout the world.

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